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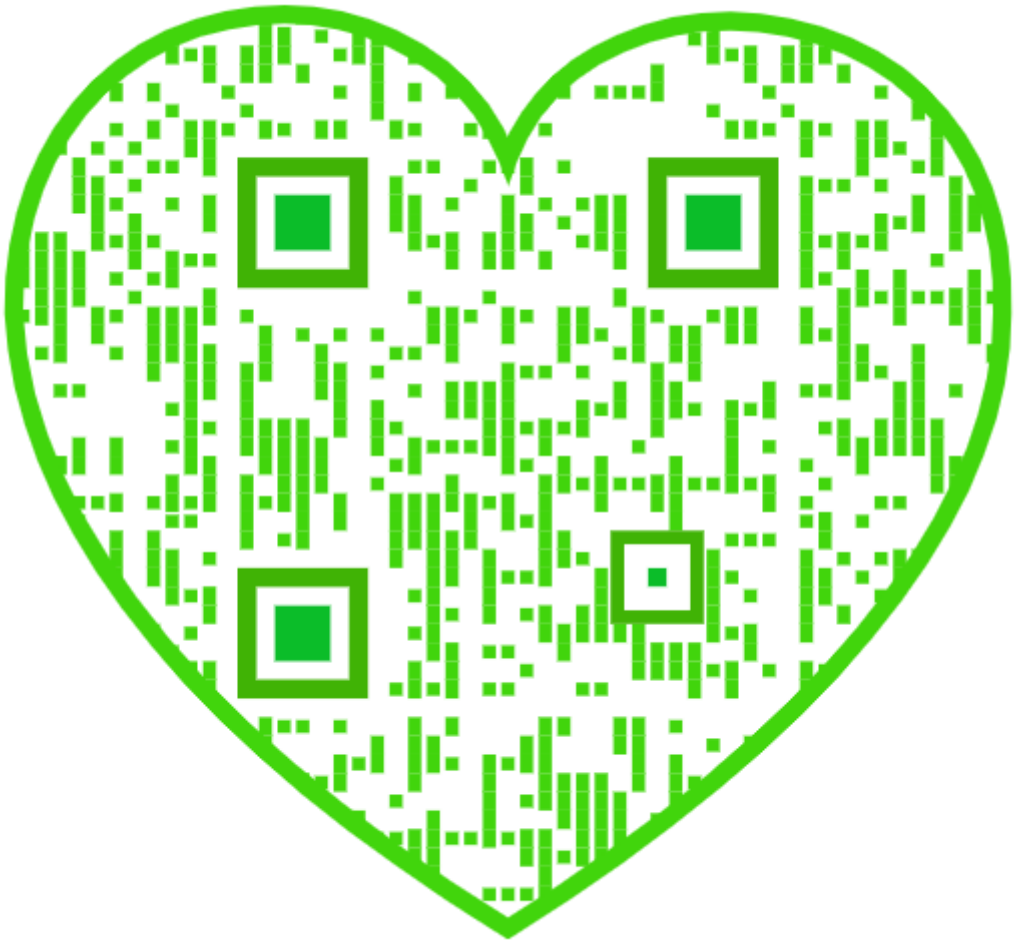

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THE
PRACTICE OF OBSTETRICS

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THE

PRACTICE OF OBSTETRICS

DESIGNED FOR THE USE OF STUDENTS AND PRACTITIONERS OF MEDICINE

BY

J. CLIFTON EDGAR

PROFESSOR OF OBSTETRICS AND CLINICAL MIDWIFERY IN THE CORNELL UNIVERSITY MEDICAL COLLEGE; VISITING OBSTETRICIAN TO THE EMERGENCY HOSPITAL OF BELLEVUE HOSPITAL, NEW YORK CITY; SURGEON TO THE MANHATTAN MATERNITY AND DISPENSARY; CONSULTING OBSTETRICIAN TO THE NEW YORK MATERNITY HOSPITAL

THIRD EDITION, REVISED

With 1279 Illustrations, including five colored plates and 38 figures printed in Colors

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TO THE

STUDENTS OF OBSTETRICS

OF THE PAST DECADE AND A HALF, WHOM IT HAS BEEN MY PRIVILEGE TO INSTRUCT, THIS BOOK IS DEDICATED BY THE AUTHOR

PREFACE TO THE THIRD EDITION.

When the first edition of this book appeared three years ago, the author stated in the preface that "the aim of the present Practice of Obstetrics is to present the subject of midwifery from a practical and clinical standpoint, so that it will best facilitate the requirements of the student of medicine and of the active obstetrician." "To this end the simplest classification has I believe been adopted." This object the author has kept constantly before him in the revisions for the new editions, and how far success has attended his efforts is attested to by the demand for 11,000 copies of the work in less than three years from its publication.

The classification adopted in the first edition has been adhered to in the subsequent ones, as from the experience of other teachers and that of the author it has been found generally satisfactory.

It has been the author's purpose in the third edition to weigh carefully such criticisms as have appeared, and when possible to meet them.

The principal criticism, that the book was too large, has been answered by reducing its size in the present edition by about one hundred pages, although much new matter and 140 new illustrations have been added. This has been accomplished by rewriting, condensing, the omission of some now obsolete matter, and reducing the size of some of the illustrations.

Again, it will be noted that the classification is rendered more graphic by the addition of page numbers to the ten part headings throughout the book.

It will be noted in comparing the second and third editions that the following new subjects have been added to the latter, namely: 1. Appendicitis Complicating Pregnancy. 2. Tapeworm Complicating Pregnancy. 3. Fibroma Molluscum Gravidarum (Illustration). 4. Hematoma of the Vulva (Illustration). 5. Lactation Atrophy of the Uterus and Breasts. 6. Brachial Birth Paralysis. 7. Vaginal Incision and Drainage (Illustration). 8. New History Charts for Institution Work.

It will be still further noted that the following subjects have been rewritten, in whole or in part: 1. The Development of the Ovum, Embryo, Fetus, Fetal Membranes, and Fetal Structures. 2. Chorio-epithelioma Malignum. 3. The Treatment of Placenta Prævia. 4. The Toxemia of Pregnancy. 5. The Etiology of Eclampsia. 6. Ectopic Gestation. 7. Treatment of Pelvic Deformity. 8. Morbidity in the Puerperium. 9. Indications for the Induction of Abortion and Premature Labor. 10. The Forceps. 11. Cæsarean Section. 12. Vaginal Cæsarean Section. 13. Porro-Cæsarean Section. 14. Complete and Incomplete Abdominal Hysterectomy.

From the foregoing changes it will appear that much time and work have been expended in the present edition in bringing the embryology and pathology of the subject up to date, and that the section on Obstetric Surgery has been largely rewritten and added to.

The author still believes it is inadvisable in a text-book designed for students to burden the text with extensive bibliography and history of the various subjects treated; hence he has introduced this matter only where he has deemed it advisable.

The clinical material and experience found in this book were obtained by the author as Attending Obstetric Surgeon during the past eighteen years in The Bellevue Emergency Hospital; The New York Maternity Hospital; The Midwifery Dispensary; The Society of the Lying-in Hospital; The Mothers' and Babies' Hospital; and The Manhattan Maternity and Dispensary.

During the above period at least 20,000 cases of confinement have come more or less under the personal observation of the author. With two of the foregoing institutions named, The Bellevue Emergency Hospital and The Manhattan Maternity and Dispensary, the author is still actively connected as attending surgeon.

For the third time the author desires to express his thanks to the publishers for their continued generosity and courtesy.

J. Clifton Edgar.

50 East 34th Street, New York City.
October 15, 1906.

PREFACE TO THE SECOND EDITION.

The exhaustion of the first edition of this Practice of Obstetrics within four months of the date of its publication, and the many complimentary reviews which have appeared and personal letters received by the author, have been most gratifying, and I desire to express my appreciation of the fact that my efforts to present the subject of obstetrics from the practical and clinical standpoint have not been entirely unsuccessful.

Too short a time has elapsed since the appearance of the first edition to make necessary a complete revision of the work.

1. Under Pathological Pregnancy will be found a section on "The Toxemia of Pregnancy," and under this latter subject I have placed, (1) Nausea and Vomiting, (2) Icterus, (3) Convulsions and Coma, (4) Eclampsia.

2. The section on Fever in the Puerperium in Part VIII of the first edition, which included Puerperal Sepsis, has been entirely rewritten and brought up to date under the heading of Morbidity in the Puerperium.

3. All the colored plates of the first edition have been remade, and three new ones have been added to the second edition, namely, two of the Toxemia of Pregnancy, and one of the Stools of Healthy Breast-fed Infants.

4. It will be noticed that many of the illustrations of the first edition have been redrawn, and that forty-five new illustrations have been added to the second edition. Some typographical errors have been corrected and a number of minor changes made throughout the text.

5. I find it necessary in the present edition to restate my position regarding the indications for Embryotomy and Cæsarean section, which from the standpoint of laboratory and theoretical obstetrics were apparently misunderstood and therefore criticized.

I find it unnecessary, however, in the second edition to change the relative amount of space devoted to Embryotomy and Cæsarean section, namely, eighteen pages to the former and eight to the latter; because Embryotomy comprises eight distinct operations, many of them complicated, and some of them frequently performed upon the dead fetus, while Cæsarean section, on the other hand, is a single and simple operation, and not so frequently made use of.

It is a far cry in obstetrics from the theoretical deductions of the library and the laboratory to the clinical conditions we find at the bedside.

The amount of space devoted in the present edition to the Toxemia of Pregnancy does not imply that the existence of a universal toxic pregnant state is

yet established or even fully believed in. The subject is daily assuming increasing importance and interest, and it is to be hoped that the physician will study his cases of pregnancy with this possibility in mind, will record and report his observations, and will especially give his patients the benefit of any doubts which may arise when the question of a toxic state is in any way suggested.

I desire to express my indebtedness to James Ewing, M.D., Professor of Pathology in the Cornell Medical College, for much valuable help in the preparation of the section upon The Toxemia of Pregnancy.

Again I wish to thank the publishers for their continued generosity and courtesy.

J. Clifton Edgar.

50 East 34th Street, New York City.
June 1, 1904.

PREFACE TO THE FIRST EDITION.

This Practice of Obstetrics is founded upon fifteen years' work in maternity hospitals and in bedside and didactic teaching.

The clinical and theoretical material collected from these sources has been rearranged, rewritten, and as far as possible compared with modern authorities. The aim of the present Practice of Obstetrics is to present the subject of midwifery from a practical and clinical standpoint, so that it will best facilitate the requirements of the student of medicine and of the active obstetrician. To this end the simplest classification has, I believe, been adopted. I have omitted as unnecessary in such a work the elaborate section upon the anatomy of the female genital organs usually found in the works upon obstetrics, and have entered directly upon the physiology of these organs. The omission of the separate section upon anatomy is to avoid repetition, since the anatomy, histological and topographical, of the pelvis and its contents will be found in its appropriate place under the Parts on the Physiology of Pregnancy and Labor. I have divided the work into ten Parts, namely: I. The Physiology of the Female Genital Organs. II. Physiological Pregnancy. III. Pathological Pregnancy. IV. Physiological Labor. V. Pathological Labor. VI. Physiological Puerperium. VII. Pathological Puerperium. VIII. The Physiology of the Newly Born. IX. The Pathology of the Newly Born. X. Obstetric Surgery.

This classification, elaborated and broadened from year to year, is practically the same that I have followed during the above period in the two departments of teaching. Several innovations will be found in this book.

1. At the beginning of each Part the table of the contents of the part in question has been placed, and to further insure ease of reference each Part is subdivided into sections, each section in turn headed with a sub-table of its subject-matter.

2. The subjects of asepsis and of pelvimetry, including cephalometry, are treated under The Examination of Pregnancy. I believe that this is the proper time and place for the student to be drilled in these subjects.

3. The subject of Deformities and Monstrosities of the Fetus has been entered into more fully than usual under Antenatal Pathology, with 144 illustrations, including all of the common and most of the rarer monstrosities.

4. The illustrations of the mechanism of labor and moulding of the fetal skull in vertex, bregma, brow, face, and pelvic presentation are mostly new, and are arranged as it has been my custom to teach these subjects. The illustrations of cervical engagement of the presenting part were obtained by palpating with two fingers of the left hand, and at the same time sketching with a soft pencil in the right hand. Inspection of the cervical engagement by the aid of a perineal retractor and reflected light was also used, but this method was less satisfactory than palpation except in the case of face presentation. The illustrations of vulval engagement of the presenting parts are from flash-light

photographs. Most of this work was done at the Emergency Hospital of Bellevue Hospital. The photographs of fetal skulls showing the result of head moulding are from skulls in the author's collection, which now numbers over one hundred.

5. Short sections upon the medico-legal aspects of obstetrics, together with a brief study of Rape, the latter including an analysis of six hundred consecutive examinations for evidences of the same, are placed under their appropriate Part headings.

6. I would especially call attention to the following subjects: (1) The relation of tuberculosis to pregnancy. (2) The teeth in pregnancy. (3) Antenatal pathology. (4) Monstrosities, and deformities of the fetus. (5) Labor in elderly primiparæ. (6) Prophylactic diet in fetal dystocia. (7) Prematurity and asphyxia of the newly born. (8) The diseases of the newly born. (9) Posture in obstetrics, and Obstetric Surgery. (10) The complete presentation of the subject of cephalometry. (11) New method for illustrating the mechanism of labor. (12) Pelvic Deformity. (13) Morbidity in the Puerperium. (14) An appendix on obstetric history keeping.

Radiography in obstetrical practice is still in its infancy and the results as to fetography have been disappointing. On the other hand, Röntgen photography of the maternal pelvis is a highly promising field, but as yet offers no practical advantages.

As far as possible the subject of Embryology has been considered from the practical and clinical standpoint, and detail has been omitted as not suited to a work on practical obstetrics. Anatomical descriptions, except as necessary for the subjects of pregnancy and labor, have also been omitted.

Much work had been expended upon the section on antenatal diseases of the fetus, before the appearance of Dr. Ballantyne's pioneer book upon Antenatal Pathology. This work I have freely consulted in the revision of my manuscript.

The 2200 confinement cases from which many of my statistics are drawn comprise 1000 cases from the New York Maternity Hospital and 1200 from the Mothers' and Babies' Hospital; 800 of the latter being dispensary or outdoor cases. The bound histories of these cases have been presented to the New York Academy of Medicine, and are there available for inspection.

All unnecessary division into chapters has been discarded, and as far as possible italicizing has also been avoided. To replace the latter a system of paragraphing by means of display type in four series has been uniformly adopted throughout, supplemented by numerical divisions. It will be observed that as far as possible full-page illustrations have been avoided. My aim has been to insert the illustrations in the midst of the text itself so as to more readily catch the eye of the reader. To this end a rather wider page of printed matter than usual has been made use of and the illustrations are of moderate size. Many of the illustrations are new, collected during fifteen years of clinical work, and most of those taken from other sources have been redrawn.

The illustrations, as will be noted, are not reproduced to a given scale, as I have found that clearness of detail is best obtained by the use of different scales of reproduction. All weights and measurements are given in English, with the metric system equivalents in parenthesis.

To Simon Henry Gage, B.S., Professor of Histology and Embryology in the Cornell University, I am indebted for his critical revision of my manuscript on "The Phenomena Produced by Pregnancy within the Uterus." Also to Drs. Edward Preble and Emma E. Walker for much valuable assistance in the search

through recent foreign obstetric literature and in the preparation of the index. The drawings for the illustrations were executed by Frank Stout, Howard J. Shannon, Frederick A. Fulton, and H. C. Lehmann.

The author desires to thank most cordially the successive members of the House Staffs of the New York Maternity Hospital, and Emergency Hospitals, for valuable assistance in the preparation of the histories and records of obstetric cases; also Mr. Kenneth M. Blakiston, of the publishing firm of Messrs. P. Blakiston's Son & Co., for his unfailing courtesy in the many details of the preparation of the illustrations and the publication of the work.

J. Clifton Edgar.

50 East 34th Street, New York City,
June 15, 1903.

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I. OVULATION.

Definition.—This term includes the formation, growth, and expulsion of the mature ovum from the ovary. The chief function of the ovary is accomplished in this process. It takes place spontaneously in all viviparous animals.

Origin of the Ova.—The ova originate from certain cells which are derived from the ingrowth of the germinal epithelium that surrounds the young ovary, and which are gradually differentiated into the female generative elements. This occurs very early; in fact, the formation of the Graafian follicles is nearly completed during the antenatal period. After birth the formation of new cells is much restricted, and at the end of the second year is supposed to cease entirely. The ovaries of a child of two years are estimated to contain about 70,000 Graafian follicles. The greater number of ova never arrive at maturity. Before puberty some of these immature ova undoubtedly develop to a certain point, but it is not until the establishment of menstruation that the normally complete maturation of the follicles with their ova takes place. With the advent of puberty the surface of the ovary becomes covered with small projections. These prominences are the Graafian follicles, which are distended by the liquid within them. They approach the ovarian periphery, cause a thinning of the tunica albuginea, and give rise to the vesicles before mentioned. Gradually the blood-vessels and lymphatics disappear, and at a certain point the covering of the follicles becomes thin and translucent, usually at the place called the macula, or stigma folliculi. When the follicle reaches maturity it bursts, discharging its contents, which consist of an ovum, the liquor folliculi, and a few cells of the discus proligerus. This change takes place periodically, now in one, now in more than one follicle, during the entire child-bearing period. Several follicles in different stages of development may be found at the same time. The particular follicle that is nearing maturity becomes congested and some of the enlarged blood-vessels burst into its cavity, thus increasing the distention and the tendency to rupture. When mature, the follicle is, on account of the escaped blood, of a bright red color. As to the time of rupture of the follicle, whether it occurs before or after menstruation, is a question not yet definitely settled. In order that the ovule may escape, not only must the layers of the follicle be lacerated but also all of the structures covering it.

Causes of Rupture of the Graafian Follicle.—Follicular rupture is produced by a combination of several factors: (1) By the pressure of the liquor folliculi, which causes thinning and absorption of the theca folliculi, the follicular wall having been weakened by fatty degeneration of the tissues. (2) By the proliferation of the lutein cells, causing the tension of the liquor to be raised. (3) By the swelling of the ovary at every menstrual period. (4) By the contraction of the ovarian muscular fibers. (5) Ovulation is a periodic process, and in nearly all mammals, except man, it occurs only at certain seasons of the year, so that the young are born at a time when food suitable for the parent is most abundant. (6) Sexual congress may influence the discharge of the ovum, probably only hastening the normal process. (7) The sympathetic nervous system also in some way affects the process.

Mechanism of the Conveyance of the Ovum to the Tubes and Uterus.—The oldest theory of this conveyance, that held by Rouget, was that the fimbriated extremity of the tube became erectile and, aided by muscular contraction, grasped the ovary. The existence of a peculiar erectility in the Fallopian tubes has, however, been disproved, as experiments show that it possesses none of the characteristics of erectile tissue. Galvanization of the tubes shortly after death produces only a vermicular action which has no effect on the position of the fimbriæ. Kehrer's theory was that the ova were ejaculated from the follicle into the tube, a view that has been upheld by few. The most probable theory is that of Henle, that the ova are carried along in the serum by currents generated by the ciliated epithelium which covers the fimbriæ of the tubes. This ciliary motion causes a current in Douglas' cul-de-sac. This action has been demonstrated by Pinner, who injected powdered insoluble coloring-matter into the abdominal cavity of a rabbit. Particles were found after death in the uterus and vagina. The same phenomenon was observed by Jani (Weigert's laboratory) in regard to tubercle bacilli. Lodi injected the eggs of a tapeworm into the peritoneal cavity of rabbits and recovered them in the tubes and uterus. In the lower animals the majority of the ova pass into the tube, but in man it would seem that the greater part are thrown into the abdominal cavity. It is usually stated that it takes eight days for the ova to reach the uterus. In a certain number of cases there is a migration of ova, which pass across the abdominal cavity and come down the opposite tube. This is called external migration. Pathological conditions afford proof of this fact. There are two classes of such cases: (1) With normal tubes. If we find a corpus luteum in the right ovary and the right tube converted into a hydrosalpinx, the inference of external migration may be drawn. Also in tubal pregnancy: given an occluded right tube with a corpus luteum in the right ovary, and a pregnancy in the left tube with no corpus luteum in the left ovary, and we must draw the same inference. (2) In the case of bicornate uterus a corpus luteum may be found in one ovary and pregnancy in the other side of the uterus. Kussmaul was the first to advocate this view of external migration. Leopold and others have experimented by removing in an animal a tube and the opposite ovary. Later, if the animal became pregnant the proof of external migration was positive. I have repeatedly demonstrated this external migration of the ovum by operating upon rabbits in the Loomis Laboratory. Older writers declared that there was internal migration causing tubal pregnancy in the opposite tube, the ovum having passed through the uterus. This statement cannot be denied, neither can it be proved. Hence we see that external migration does take place, whereas the occurrence of internal, though possible, has not been proved.

Corpus Luteum.—After the follicle has ruptured and the ovum has been cast off, the corpus luteum is formed. As has been said, previous to rupture there has occurred a fatty degeneration of the cells of the membrana granulosa and of the discus proligerus. There is a certain amount of hemorrhage within the follicle, the walls collapse, and this is the first stage of the corpus luteum. The hematin of the extravasated blood gives rise to the "yellow" color. The cells of the internal layer of the theca folliculi rapidly proliferate, forming festoons which project into the blood-clot contained in the cavity of the follicle (Fig. 1). This yellow layer is quite thick, being about one-half the thickness of the whole corpus, which measures half an inch (1.25 cm.). These cells are lutein cells. The stroma of the ovary also sends ingrowths into this mass. The blood-clot organizes, the walls contract, and finally a small, irregular cavity is left. This is at last obliterated by the meeting of the walls, and merely a cleft remains. A corpus luteum is formed

with every bursting of a follicle. When fertilization of the ovum occurs, the corpus luteum becomes larger. The old terminology recognizes a *corpus luteum verum* and a *corpus luteum spurium*. The corpus luteum of pregnancy measures from about four-fifths to one inch (2 to 2.5 cm.) in diameter, while the ordinary corpus luteum measures about three-fifths inch (1.5 cm.). For some time the idea obtained that there was a marked difference between the corpus luteum verum and the corpus luteum spurium; it has, however, been shown that the only difference is that of size, due to the greater blood-supply during pregnancy. There has been endless discussion about the corpus luteum, the principal point of dispute being the hyaline change.

Retrograde Changes in the Corpus Luteum.—After the formation of the corpus luteum the yellow layer is converted into a hyaline mass which is penetrated by a

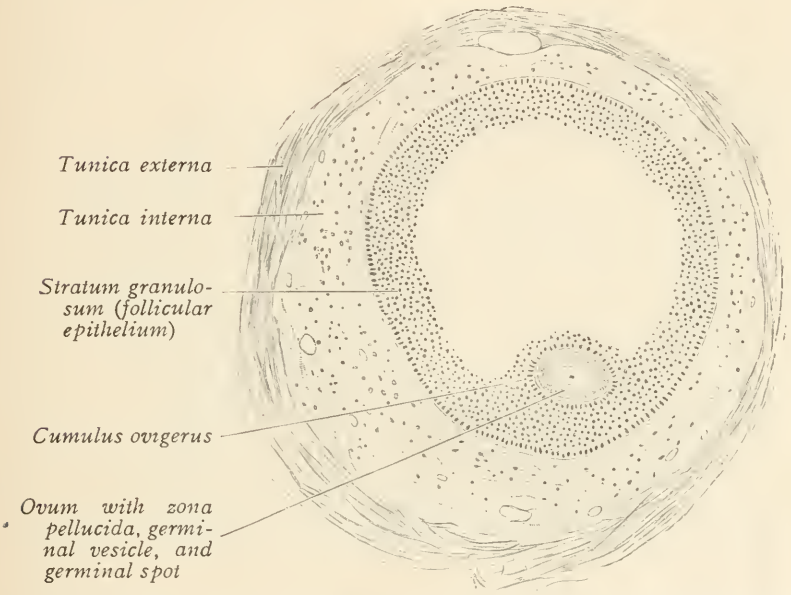


FIG. 1.—SECTION OF A LARGE GRAAFIAN FOLLICLE OF A CHILD EIGHT YEARS OLD. × 90. The clear space within the follicle contains the liquor folliculi.—(*Stöhr.*)

few bands of ovarian stroma. Finally a thin layer of connective tissue is the only representative of the blood-clot, and this stage is known as the corpus fibrosum or corpus albicans. But still further changes must go on, for only a few of these bodies are to be found in an ovary. The minor details of these changes are not well known. The ovarian stroma prolongations increase, while the hyaline material diminishes and assumes bizarre forms. At last there may be only a trace of connective tissue remaining. Only twenty or thirty follicles rupture in a year and many ova disappear. Many follicles never rupture at all.

Obliteration of Follicles which do not Rupture.—The ovum may assume signs of maturity, fatty degeneration takes place in the membrana granulosa, the whole mass dissolves in the liquor folliculi, and the fluid finally disappears and the walls collapse. There is absence of blood-clot. The follicle is surrounded by a thin hyaline stratum formed from the inner layer of the theca folliculi.

II. MENSTRUATION.

Synonyms.—Menses; Menstrual flow; Menstrual flux; Flow; Catamenia.

Definition.—By menstruation is meant the monthly hemorrhage which takes place in the uterus during the child-bearing period of the normal woman, except during pregnancy and lactation, when it is nearly always suspended.

Puberty.—The first occurrence of menstruation with the accompanying changes marks the stage of sexual maturity at which, in the female, fecundation becomes possible. The signs are: The growth of hair on the pubes and on other parts of the body; the enlargement of the breasts; the increased grace of the general contour of the body; the establishment of ovulation and menstruation; the full development of the pelvis; the growth of the sexual sense; alteration in

FIG. 2.—UTERUS AND ADNEXA SHOWING COINCIDENT MENSTRUATION AND OVULATION. Suicidal death from morphine on second day of menstruation.—(*Author's specimen.*)

the mental qualities, the girl becoming more retiring. The menstrual function is not generally established at once, but for the first few months there may be only premonitory symptoms of a vague and uncomfortable nature. There may soon occur a slight discharge of mucus tinged with blood, and later the regular menses will be established.

Phenomena.—(1) The GENERAL PHENOMENA consist of pains in various parts of the body, chilliness, heat flashes, and hysterical symptoms. The reflex nervous system is always at its maximum point of irritability and there is often depression with drowsiness. There are general discomfort, weariness, and a marked distaste for active exercise. Dark circles appear under the eyes, the breasts swell and become painful, and a sense of fulness and oppression is felt in the head (Fig. 6). There are often considerable changes in the general nutritive processes and the excretion of urea by the kidneys is lessened. (2) The LOCAL PHENOMENA are those of pelvic congestion. Rupture of an ovisac occurs, the

uterus becomes much congested, the cervix softens and is of a bluish color with relaxation of the external and of the internal os. The uterine mucous membrane is also swollen, congested, and raised into folds which give the surface an irregular appearance (Fig. 2); abundant secretion pours from the glands, and, at least in some cases, the epithelium desquamates, and the capillaries losing their support, their walls undergo fatty degeneration, burst, and discharge the blood (Fig. 4). The tubes are also congested and thickened, and blood sometimes escapes into them. The vagina becomes darker in color, gland secretion is abundant, and the temperature is slightly elevated, often by 1° F. (0.5° C.) (Fig. 7). The whole vulva is swollen and tense and pruritus may occur (herpes menstrualis).

Changes in the Endometrium during Menstruation.—Various views have been held as to the changes in the uterus at this time. The prevailing view is that a certain amount of the mucosa, though small, is cast off; that there is fatty degeneration of the walls of the blood-vessels which permits the outflow of blood, and this is the primary change during menstruation. The flow arises from diapedesis of the blood-corpuscles. The amount of blood is comparatively small and does not really constitute a true hemorrhage. The flow is preceded by alterations in the glands, which become hypertrophied and present a zigzag appearance on cross-section, while the cells in the lower part of the glandular structure may become larger and resemble epithelial cells. The connective-tissue cells also undergo hypertrophy (Figs. 4 and 3).

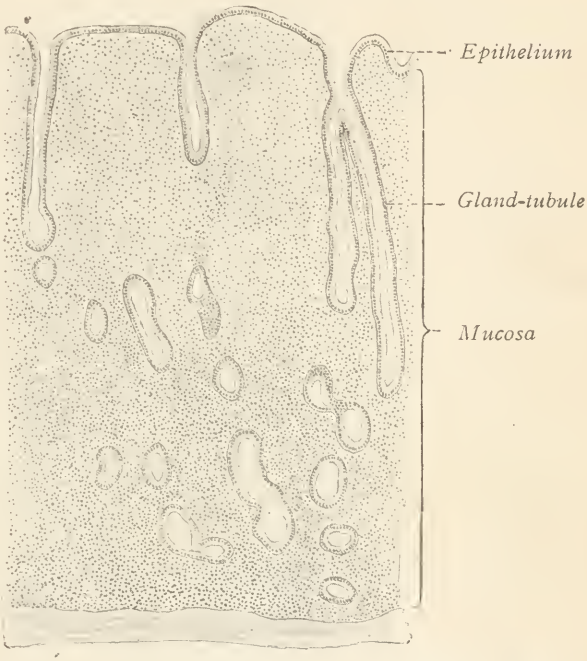


Fig. 3.—Mucous Membrane of the Resting Uterus of a Young Woman. × 35.—(*After Böhm and von Davidoff.*)

Time of Occurrence.—As has been stated, the establishment of puberty ushers in the process of menstruation. The accompanying physical changes give evidence of the capacity for conception and childbearing now assumed by the woman. In temperate climates the average age for the beginning of menstruation is the fifteenth year. There are, however, many exceptions to this rule within normal limits, as it is not so very uncommon to observe the beginning of this process at the tenth or eleventh year, or its delay to the eighteenth or twentieth. The average age in India is said to be the ninth year, while in Iceland it is given as the sixteenth year. There are recorded curiously abnormal cases of menstruation, pregnancy, and childbirth in early childhood, also of childbirth years after the menopause, which normally occurs about the forty-fifth year.

Conditions Influencing Menstruation.—Menstruation is influenced by (1)

race; (2) mode of life; (3) climate; (4) heredity; and (5) genital sense. Some authors lay considerable stress on the influence of race. It is said that English girls in Calcutta menstruate no earlier than in England, although subjected to the same climatic influences as the Hindoos, 1 or 2 per cent. of whom menstruate as early as the ninth year, while 25 per cent. menstruate at twelve years of age. The children of the superior classes, being of a higher nervous organization, are apt to menstruate earlier. Their manner of life is more luxurious and mental stimulation is premature, as shown in the earlier period of menstruation. As to the influence

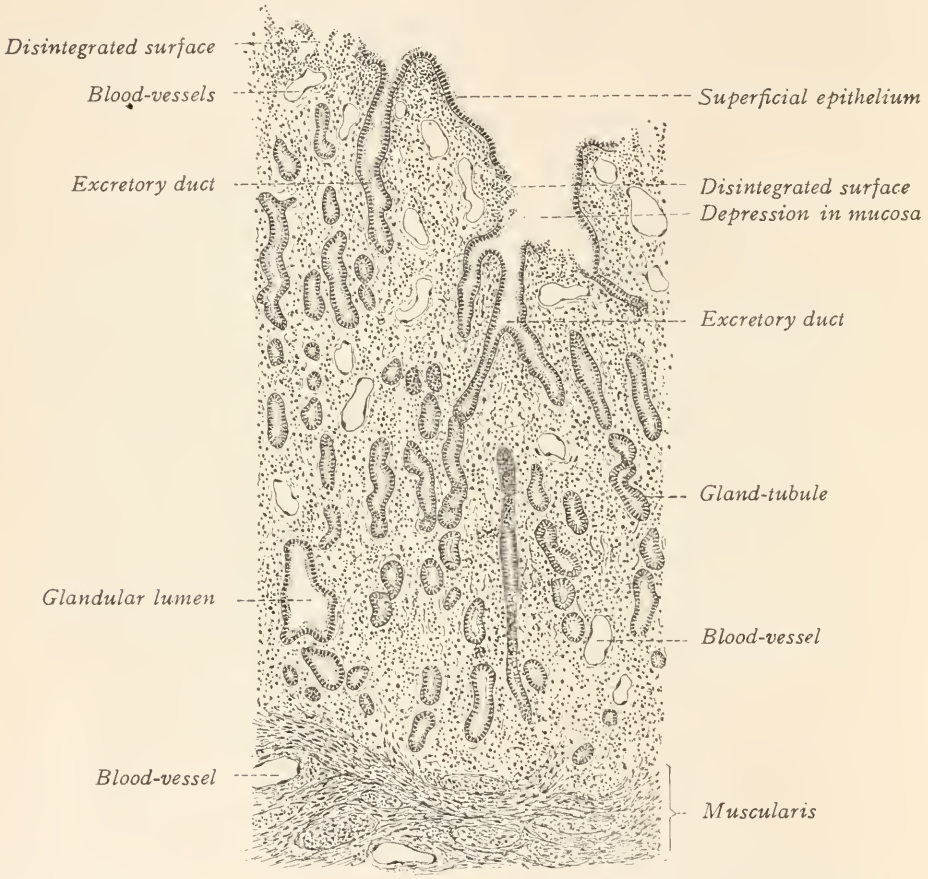


FIG. 4.—MUCOUS MEMBRANE OF A VIRGIN UTERUS DURING THE FIRST DAY OF MENSTRUATION. × 30.—(*Schafer.*)

of climate, it has no doubt been exaggerated, although the general rule holds that menstruation occurs somewhat earlier in the tropical than in the arctic regions. Premature or late sexual development is often noticed as a family trait. Sexual excitement is thought to influence the advent of menstruation, and Clay * has noted this excitement among the hard-working factory girls of Manchester, where, in the nature of the work, there is a promiscuous mixing of sexes. In the case of pregnancy, menstruation is nearly always suspended during the whole period of gestation, recurring from six to eight weeks after the birth of the

* "Brit. Record of Obstet. Med.," vol. 1.

child. Exceptions to the rule of suspended menstruation in pregnancy occur now and then during the early months, and are explained by the fact that the uterine cavity is not obliterated by the junction of the decidua reflexa and the mucous membrane of the uterus, or the decidua vera, till the close of the fifth month. In case the menses continue throughout pregnancy,—a very rare condition indeed,—there is probably an abnormal and incomplete fusion of the deciduæ. Naegele * held that menstruation regenerates the capacity for conception which had failed by degrees during the intermenstrual period. The relation between menstruation and the "heat" of lower animals is a very interesting study. The most satisfactory theory appears to be that menstruation is caused by a central nervous influence reflected through the sympathetic nervous system to the ovaries and uterus.

The Menstrual Cycle.—The entire menstrual cycle comprises four stages (Marshall), and extends, as a rule, over twenty-eight days: (1) The preparatory or constructive stage consists in making ready for the reception of the ovum. This preparation, according to Marshall, is probably made for the ovum which is discharged at the preceding period, for it is probable that a week is consumed in the migration of the ovum from the ovary to the uterus. When pregnancy does not occur, this stage is followed by degenerative changes. (2) The destructive stage comprises all the ordinary phenomena of menstruation. It lasts about five days, varying, however, according to individual peculiarities. (3) The reparative stage is occupied with the regeneration of the destroyed parts of the uterine tissue—the focus of new growth being the unharmed deeper tissues still existing. This process takes place in from three to four days. (4) The quiescent stage comprises the remaining twelve or fourteen days of the whole cycle and just precedes the beginning of the next period.

Menstruation is Temporary, Intermittent, and Periodic.—It is temporary because it exists only during the sexual life of the woman, asserting itself at puberty and declining at the menopause till it ceases altogether. It is intermittent because it comes and goes, and periodic because the series of phenomena representing this physiological process reproduce themselves at intervals of usually one month, being the result of the hyperemia which occurs in the whole genital system of the woman—ovary, tubes, uterus, and broad ligaments. Periodicity is variable, but twenty-eight days is considered the normal period. Two sisters are mentioned in whom menstruation occurred only two or three times a year (Joulin).

Duration.—The duration of menstruation averages five days, but varies from three to seven. Some cases are known in which menstruation lasts only a few hours, others in which it lasts many days.

Quantity of Blood Lost.—The total amount lost varies normally from five to ten ounces. The amount, even if rather large, need not be considered abnormal unless the general health suffers. High living, rich diet, and, indeed, anything that abnormally stimulates mind and body, will tend to increase the flow. Consequently city-bred girls and those of the higher classes have a greater flow than the hard-worked women of the laboring classes. It is also greater in warm climates than in cold, and English women in India menstruate profusely, while on their return to England there is marked decrease of the flow. The same fact has been noted in American women moving from the Southern States to the Lake region. It appears that women sometimes menstruate more profusely in summer than in winter. The daily loss is not the same during the period. It is slight at first, as a rule, reaches the maximum on the third day, and then gradually de-

* "Erfahrungen und Abhandlungen," Mannheim, 1812.

creases. At the last it often ceases for a few hours and then returns. Emotion or excitement of any kind is very apt to bring it on.

Composition of the Menstrual Blood.—The discharge is made up of water, red and white blood-corpuscles, mucus-corpuscles, abundant epithelial cells from the uterus and vagina, and rarely strips of uterine mucosa. Virchow believes that some of the epithelium comes from the interior of the uterine glands. The direct discharge from the uterus consists of pure blood, and if it is collected by the speculum it will coagulate. The fact that ordinary menstrual blood does not coagulate has caused much speculation. Mandl has given the true explanation by showing that small quantities of mucus or pus will keep fibrin in solution, and that the former is always found in the secretions from the cervix and vagina and mingles with the blood in its passage from the uterus to the external world. However, in case of excessive flow there will not be sufficient mucus to act on all the fibrin. The color is generally dark at first, while later it becomes paler. Women in poor health often have a very pale discharge. The amount of intermingled mucus doubtless has much to do with the differences in color. The reaction is alkaline. There is always a faint odor to menstrual blood which is characteristic. It has been likened to that of marigolds. It is probably due either to decomposing mucus or to the mixture of the secretions of the vulvar sebaceous glands. This peculiarity has been noted from the earliest times, and even now in England on many farms the old prejudice of the deleterious effects of menstrual blood is seen in the custom of not allowing menstruating women to attend to the making of butter, preserves, cheese, etc. The influence of menstruation on the general health is very apparent. It is quite common to observe symptoms of marked toxemia occurring a day or two before the flow, such as headache, nausea and vomiting, jaundice, vertigo, and high blood-pressure, which subside upon the establishment of the hemorrhage.

Modifications and Anomalies of Menstruation.—At times menstruation occurs through the skin of the mammæ. This is probably due to their intimate sympathetic connection with the generative organs. Bleeding may also take place from the surface of an ulcer or from hemorrhoids. All of these locations are such as to give easy external escape to the blood. In other cases the bleeding occurs from the nose; or there may be vomiting of blood or bleeding from the lungs. Cutaneous hemorrhage may take place. Vicarious menstruation is generally a sign of ill health and is usually seen in young women of highly nervous organization. It may begin at puberty and continue throughout the entire sexual life. Its occurrence is periodic, corresponding with the menstrual nisus, although the amount of blood is generally considerably less than that lost in normal menses. We find also such abnormalities as menorrhagia, dysmenorrhea, and retention of menses from obliteration of the neck of the uterus or the vaginal orifice. Other modifications are in the suppression of menstruation from pregnancy, from lactation, or from emotion.

Relation between Menstruation and Ovulation.—This relation is not entirely clear. Menstruation is not necessary to child-bearing, but there is a marked connection between ovulation and menstruation. Various theories are advanced: by Pflüger, that the presence of the ripe follicle causes a reflex action which brings on menstruation; by Strassmann, that menstruation is due to pressure changes in the ovary. To prove this he injected a sterile fluid into the ovary and found the animal went in "heat" as a result. It has also been observed that on the second or third day after ovariotomy the patient often undergoes a pseudo-menstruation, probably caused by the pressure of the ligatures; also that menstruation may continue after ovariotomy. Some have

tried to explain this by saying that a portion of the ovary had been left behind or that the discharge was due to some pathological condition not noticed at the time. These cases, however, are too numerous to be explained on the supposition of a mistake. Leopold showed that ova mature at all times, both before puberty and after the menopause, and this was observed by others. Löwenthal thought that menstruation depended upon non-fertilization of the ovum; that is, was a primitive abortion. Variations of three weeks have been noticed in the time of delivery corresponding to fertilization just before or just after menstruation. Young girls have also become pregnant before menstruation began, and ruptured follicles have sometimes been found in the ovary in the intermenstrual period. Pregnancy seldom occurs during lactation, though menstruation begins much sooner than the end of lactation. Lawson Tait believed that there are nerves from the tubes to the sympathetic system, and these he called menstruating nerves. All of these facts make the relationship of menstruation to ovulation somewhat obscure. The following conclusions, however, may safely be drawn: Ovulation and menstruation occur about the same time, although ovulation often follows menstruation and may occur between the menses. The ovarian changes which precede ovulation, by producing ovarian tension, reflexly excite the uterus and cause menstruation. These changes are nearly or quite complete before the bursting of the Graafian follicle. The time of labor cannot be accurately estimated, and rules for avoiding conception are very uncertain. Both ovulation and menstruation are under some nervous control, yet either process may occur independently. Conception is more apt to result from a coitus just after a menstrual flow than at any other time. Three theories have been advanced as to these relations: (1) Ovulation determines menstruation; (2) menstrual congestion favors ovulation, since there occur simultaneously congestion of the ovary and uterus; (3) menstruation and ovulation are interdependent.

The Menopause.—The climacteric or change of life varies as widely as does the establishment of menstruation, although the average age is between forty and fifty years. Cases of women menstruating till the eightieth or ninetieth year, which have been reported, must be regarded as exceptional and as having no bearing on the general rule. The great majority of women cease to menstruate in the forty-sixth year; most cases of prolonged menstruation are dependent on pathological conditions—organic disease of some kind, malignant or otherwise. Cases in which menstruation ceased between the ages of thirty and forty years are noted, certain instances being recorded as early as the twenty-fifth year. It is the generally received opinion that women who begin to menstruate early cease to do so at a correspondingly early period, so that the average duration of the function is about the same in all women. But Cazeaux and Raciborski think differently, and they are upheld by the opinion of Guy, which he formed from the observation of 1500 cases. These authors think that the earlier a woman begins to menstruate, the longer she will continue; believing that early menstruation indicates extreme vital energy, and that this continues during the entire child-bearing epoch. Thirty years of sexual activity are considered the normal duration. Climate and other accidental factors do not seem to have so much influence on the cessation of menstruation as on its establishment. The menopause is generally ushered in by gradual changes in the amount of discharge. There are irregularities in its occurrence, and a diminution in amount, or even at times an increase, till finally it ceases altogether. The genitalia all undergo an atrophic change and nervous phenomena appear (Fig. 5). Flashes of heat are very characteristic, and both the physical and mental being may undergo altera-

tions. There is a more or less constant tendency to obesity at the time. The notions among the laity as to the great dangers of the menopause are, without doubt, greatly exaggerated. It is not uncommon to see a woman who for years has suffered from uterine and other complaints seem to enjoy robust health after this trying period has been passed. Statistics conclusively prove that mortality at this time is no greater than at any other period. Some have noted that in certain cases, especially of unmarried women, there is a loss of feminine traits

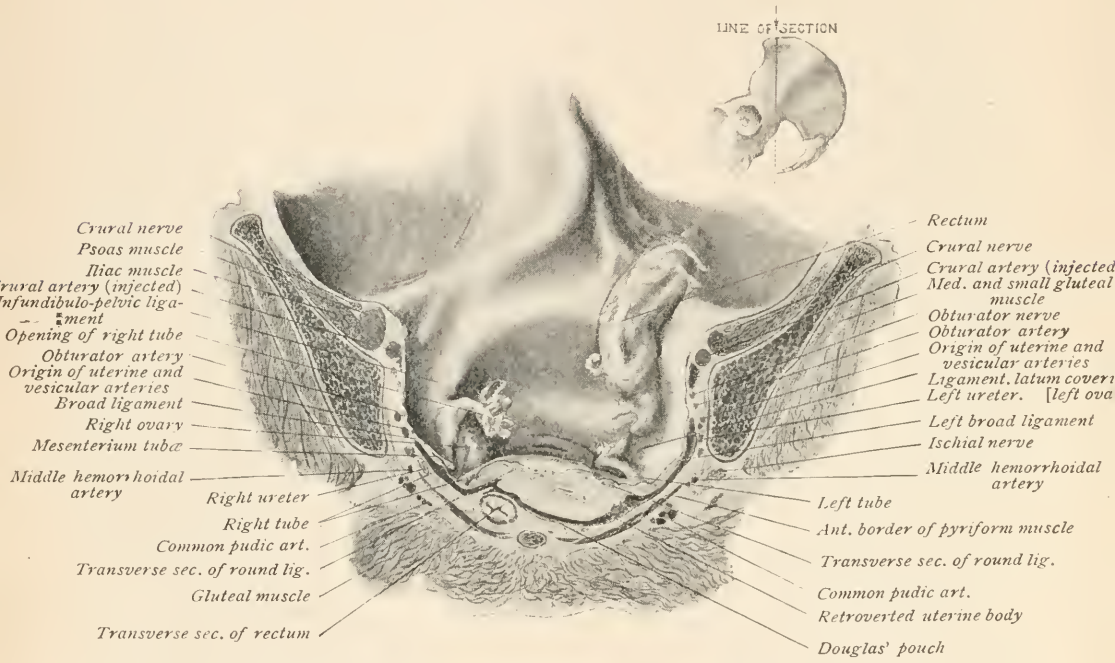


FIG. 5.—ATROPHY AND PROLAPSE OF UTERUS AND ADNEXA FOLLOWING THE MENOPAUSE.—(*Sellheim.*)

and the assumption of certain anatomical male characteristics—a more angular form, a harsher voice, or even the development of an imperfect beard or moustache.

III. INSEMINATION.

Definition.—By insemination is meant the deposition of the seminal fluid within the genital tract of the female during sexual intercourse.

Phenomena.—Before conception can take place there must be a meeting and fusion of the vital elements of the two sexes. This is brought about by coitus or copulation, by means of which the semen of the male is deposited in the vagina of the female. This act is called insemination, although fecundation does not follow unless the ovum and spermatozoon come together and amalgamate. When this occurs, the woman conceives and enters upon the period of pregnancy or gestation. The orgasm is the climax of the sexual act. Its normal occurrence is simultaneous in the male and female, and makes conception more probable. When it is not simultaneous, the cervical alkaline mucus protects the spermatozoa

FIG. 6.—BREAST OF A NULLIPAROUS MARRIED WOMAN A FEW DAYS BEFORE A MENSTRUAL PERIOD, SHOWING CHANGES IDENTICAL WITH THOSE PRODUCED BY PREGNANCY.

FIG. 7—VAGINAL MUCOUS MEMBRANE OF A NULLIPAROUS WOMAN THE FIRST DAY OF A MENSTRUAL PERIOD, SHOWING CHANGES ANALOGOUS TO THOSE PRODUCED BY PREGNANCY.

from the acid secretion of the vagina. The collection of semen covering the cervix permits the spermatozoa, by virtue of their inherent power of locomotion, to enter the uterus. This explains the occurrence of conception in cases in which the woman has been apathetic during sexual intercourse, having no orgasm, or when she was unconscious from any cause. The time at which insemination is least likely to be followed by fertilization is from the seventeenth to the twenty-third day after menstruation has ceased. It is most apt to occur on the first day after menstruation.

IV. IMPREGNATION.

Synonyms.—Fertilization; Incarnation; Fecundation.

Definition.—By impregnation is meant the union of the ovum and the spermatozoon. A woman who has never given birth to a child is called nulliparous, or a nullipara, and her condition is termed nulliparity. The state of capacity for having children is called parity. When a woman is pregnant for the first time she is said to be a primipara, or a primigravida, or a primigravidous woman, or in the condition of primigravidity. In succeeding pregnancies she is a multipara, or a multigravida, a multigravidous woman, or in the state of multiparity.

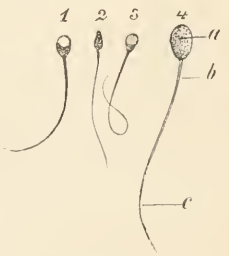


FIG. 8.—HUMAN SPERMATOZOA. × 360. 1. Viewed from the surface. 2. Viewed in profile. 3. Coiled seminal filament. 4. Spermatozoön of bull: *a*, head; *b*, middle-piece; *c*, main-piece. The end-piece and the demarcation of these parts cannot be perceived with this magnification.—(*Stöhr.*)

The Semen.—The medium by which the spermatozoa reach the female generative organs is the semen. The semen is a thick, viscid, albuminous fluid, whitish, yellowish, or opalescent in color, with a peculiar odor that has been likened to lime or to the filings of bone. It consists of the secretion of the testicles together with that of the prostate and Cowper's glands. It is composed of the liquor seminis, in which are found microscopically the seminal granules and numerous minute anatomical elements termed spermatozoa, which are the vital elements. The liquor seminis, which on chemical examination yields 82 per cent. of water, holds in solution a mucilaginous, odoriferous body called spermatin, as well as protein matter, fats, phosphates, chlorides, and other inorganic materials.

The Spermatozoa.—Each spermatozoid (Fig. 8) consists of a flat oval head, which measures about $\frac{1}{6000}$ inch ($\frac{1}{350}$ mm.) in width, and represents the nucleus of an epithelial cell; a small body, and a very long filiform tail, or flagellum, which in the living spermatozoon is in constant motion. The general appearance of a spermatozoid is that of a tadpole. These little bodies come from the specialized sperm cells of the epithelium of the seminal tubules in the testicles. The profile of the spermatozoid is pyriform in shape, and its entire length is $\frac{1}{600}$ to $\frac{1}{400}$ inch (0.05 to 0.06 mm.). The spermatozoa, the most important elements, are not passive constituents of the liquor seminis, simply floating in this medium; they are endowed with motility, and seem to dart hither and thither as though endowed with volition. It is difficult to realize, in watching the curious movements of these minute organisms, as they advance now *en masse*, now singly, at times diving down, then coming to the surface again, then in their gyrations skilfully avoiding obstacles many times their size, that they are not to a certain

extent possessed of the power of voluntary motion. However, these motions are doubtless due to the undulatory vibrations of the tail, which depend purely upon molecular tissue changes like those which give rise to the movements of ciliated epithelium, or to the ameboid movements of protoplasm. The rate of motion of the spermatozoa has been variously estimated; Henle states that they travel an inch in seven to twelve minutes, or from the hymen to the cervix in three hours (Sims). They have been found within the female genital organs, with their power of motion unimpaired, eight to ten days after they were deposited there. As soon as the spermatozoa are deprived of this motility their vitalizing power is lost. Environment has much to do with the retention of this power. Extreme heat or cold or excessively acid or alkaline secretions will destroy them. Mercuric chloride has a most untoward effect upon them, as have also the mineral poisons and lack of water. They may be dead when ejaculated, as the result of disease or catarrh of the seminal vesicles or alcoholic or sexual excess; or they may be absent from the seminal fluid in consequence of anatomical defect, or inflammation and obliteration of the seminal ducts. The seminal granule, or accessory corpuscle, is that part of the cell which is extruded in the development of the spermatozoon, and is analogous to the polar globule in the maturation of the ovum. The fifteenth or sixteenth year marks the first appearance of the spermatic particles in the sexual discharge; although there is frequently a seminal discharge several years earlier, it seldom contains these elements. Very often spermatozoa disappear from the seminal fluid of old men, sixty-five years being the average age, though many exceptions to this rule are on record. The amount of spermatic fluid ejaculated in sexual congress averages about 1 dram (3.7 c.c.) and the number of spermatozoa, as estimated by Lode, is 226,257,900. If much in excess of this, the condition is termed polyspermism; while if much less, the condition is pathological, and is designated as oligospermism.

Ascent of the Spermatozoa.—Many theories have been suggested as to the method by which the spermatozoa reach the uterus. Litzmann, Wernicke, and Beck proposed the aspiration theory, according to which the hood-like layer of the uterus contracts, forcing the cervix down into the lake of spermatic fluid, then, relaxation following, the semen is aspirated into the canal. Marion Sims' view has been received with the greatest favor. It is that the semen forms a lake in the posterior cul-de-sac, and, the cervix dipping in, the fluid passes up into the uterus. A proof of the truth of this theory is offered by the observation of the great infrequency of pregnancy in cases in which uteri, after operation, cannot dip into the spermatic fluid. It was formerly thought that the current produced by the cilia of the uterus carried the spermatozoa along their upward path, while the tubal cilia wafted the ovum toward the uterus; but Hofmeier, several years ago, showed that the ciliary motion was all in the same direction, toward the outlet of the uterus. Tubal pregnancy shows that the spermatozoa must get into the tube by their own inherent motion. Occasional cases of pregnancy in which conception occurs through a minute opening and an almost imperforate hymen prove the extreme motility inherent in the spermatozoa.

Place of Meeting of Spermatozoön and Ovum.—Various authorities have located the point of fecundation in the uterus, tubes, and ovary, and isolated observations are on record showing that fecundation may take place in any one of these organs, as the spermatozoa reach the uterus by reason of their own motility, aided by other mechanism, whence they pass to the tube and wait for the ovum, which may or may not be fertilized.

Relation between Impregnation and Menstruation.—It has been practically proved from observations on the wives of sailors and from artificial impregna-

tion* that the most favorable time for impregnation is immediately after menstruation; and also that the spermatozoa may retain their vitality in the vagina for at least seventeen days, even through a menstrual period. Instances are known in which insemination, occurring just before a menstrual period, was followed by pregnancy and delivery at term.† Menstruation under such circumstances may be perfectly normal, and the downward current of blood does not interfere with the upward passage of the spermatozoa to the Fallopian tubes. His‡ examined sixteen embryos with the utmost care. He found that in twelve the stage of development proved that impregnation had occurred, not at the time of the last, but at what would have been the next, menstrual (first missed) epoch, had not the woman become pregnant. The remaining four embryos in their development corresponded to impregnation occurring at the last menstrual period. Duncan says, in this connection, that when a fertilizing insemination takes place just before the period is due, the latter frequently "does not take place at all, or only very scantily; the uterine system, as it were, anticipating the conception and preventing the failure which might result from a free discharge of blood." It is quite evident that such cases, occurring in married women, would be very liable to be considered "cases of gestation protracted a month."

Unconscious Impregnation.—A woman may become pregnant in a state of partial or complete unconsciousness. In cases of rape young girls have been impregnated while unconscious as the result of fright, a blow, drugs, or alcohol. Impregnation during unconsciousness as the result of anesthetics, chloroform, ether, or nitrous oxide is also possible. Artificial impregnation, the seminal fluid having, with suitable instruments, been injected directly into the uterus, has also been successfully performed. Brouardel,§ who has studied and written upon this subject, states that copulation and impregnation can occur in a woman without her knowledge during hypnotic sleep. "That a woman should be unconscious both of the fact of sexual intercourse, and also continue unconscious of the resulting pregnancy up to the birth of the child, we decline to believe, unless she was feeble-minded or idiotic." (Reese.)

V. RAPE.‖

Definition.—Rape, derived from *raptus mulierum*, signifies carnal knowledge of a female by a man, forcibly and unlawfully, without her consent. It may, however, be committed by fraud or by intimidation.

Law of Rape.—Common law declares a female under thirteen years of age incapable of giving consent. Carnal knowledge between thirteen and sixteen is regarded as a misdemeanor; it is not a crime if the age is over sixteen and there is consent. The testimony of the prosecutrix alone is considered legally competent, since she and the offender are generally without other witnesses. As false accusations of rape are common, the corroborative testimony of medical evidence is generally required. In 600 accusations I could find evidences of penetration in but 386 instances. In 212 there was no evidence what-

* Bossi: "Nouvelles Archives d'Obstétrique et de Gynécologie," Paris, April, 1891.

† Milne Murray: "Edinburgh Med Jour.," Sept., 1892.

‡ "Anatomie menschl. Embryonen," Abth. I. V., II., Leipzig, 1882.

§ "Gaz. des Hôpitaux," 1877.

‖ See more exhaustive article, "Medico-legal Consideration of Rape," by Edgar and Johnston, "Medical Jurisprudence, Forensic Medicine and Toxicology," Witthaus and Becker, vol. II.

ever of penetration of the genital organs and in two cases menstruation and chancroids rendered the diagnosis uncertain. The examination should be made as soon as possible after the assault, and the physician should carefully note the time of his examination and try to obtain by inquiry the exact time of assault. The female should be allowed no time to prepare for the examination. Several points should be kept in mind and noted by the physician: (1) Signs of violence on the genitals of the female; (2) signs of violence on her body or that of the defendant; (3) evidence of blood or semen on the body or clothes of either; (4) the existence of venereal disease, syphilis, chancroid, or gonorrhea, in one or both of the individuals concerned. The evidence of masturbation and criminal assault may be present in the same instance, and in the majority of cases the medical expert can swear only to the "penetration of some blunt instrument." The subject may be treated in four parts: (1) Rape on females after puberty; (2) rape on children and infants; (3) rape by boys and women; (4) rape on the dead (necrophilia). False accusations are considered throughout the text.

1. **Rape on Females after Puberty.**—The fourchette and posterior commissure are often destroyed by the first delivery, but they are seldom injured by sexual intercourse. In 386 penetrations the fourchette was lacerated in but 17 of the cases observed by me. The hymen is the most convincing sign of virginity. It is a membranous structure guarding the entrance to the vagina and making a line of demarcation between it and the external genitals. There are four chief forms, with many variations. These are: (1) A form with a central, antero-posterior opening; (2) the semilunar; (3) the annular; and (4) the diaphragmatic. (Figs. 9 to 33.)* The first and third are the most common varieties. The imperforate hymen is a pathological condition. Is the presence of an intact hymen evidence of virginity? Although the presence of the hymen is not absolutely invariable, still it is unquestionably the most valuable physical sign. However, even when it remains uninjured, it does not offer positive proof that rape has not been committed. This is especially true in the case of young children, in whom it is deeply placed, and the organs are undeveloped; for it must be remembered that the slightest penetration is a crime. Authentic cases in which prostitutes have had perfectly preserved hymens are on record.† It may even persist after delivery, remaining as a loose ring.‡ Does the absence of the integrity of the hymen, on the contrary, indicate defloration? The greatest care must be exercised in deciding this question. The hymen may be injured manually, as in one of my cases by a midwife; or it may be destroyed by accident, as by falling astride of an object; again, violent exercise may rupture it—*e. g.*, horseback-riding. Congenital absence of the hymen is known (Fig. 35). Surgical operations or vaginal examinations, roughly conducted, not infrequently cause rupture. The breasts are only slightly affected by handling and sexual indulgence. One sign alone cannot afford positive proof of virginity, but all taken together give assurance of it. It is well known that the use of vaginal astringents may tone up and narrow the vagina and even restore the hymen to a great degree. In complete recent defloration the hymen will furnish the most convincing proof, but the external genitals may also be inflamed to a greater or less extent; and if the inflammation is extreme the patient's movements will be interfered with and she will evince a great dread of opening the thighs. These signs are most important and are seldom simulated. There may also be signs of violence on the

* Figs. 9 to 33 inclusive, and Fig. 35, are from E. Von Hofmann's "Atlas of Legal Medicine."

† Grey's "Forensic Medicine," p. 49.

‡ Stolz: "Annales d'Hygiène," 1873, t. 2, p. 148.

FIG. 9.—CIRCULAR HYMEN WITH WIDE OPENING AND CIRCULAR SMOOTH-EDGED MARGIN OF EQUABLE HEIGHT THROUGHOUT.

FIG. 10.—SEMILUNAR HYMEN.

FIG. 11.—SEMILUNAR HYMEN.

FIG. 12.—HYMEN OF NEWLY BORN CHILD WITH DEEP NOTCHES TO THE RIGHT AND LEFT.

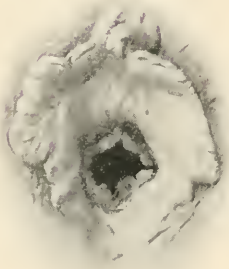


FIG. 13.—CIRCULAR HYMEN WITH DEEP CONGENITAL NOTCHES. EDGES SMOOTH AND ROUNDED.

FIG. 14.—DEEP IRREGULAR NOTCH OF THE HYMEN OF A NEWLY BORN INFANT.

FIG. 15.—CONGENITAL DEEP IRREGULAR NOTCH OF HYMEN.

FIG. 16.—FIMBRIATED HYMEN IN A VIRGIN.

FIG. 17.—SERRATED OR FIMBRIATED HYMEN IN A VIRGIN.

FIG. 18.—HYMEN BIPARTUS OR SEPTUS OR DIVIDED HYMEN

FIG. 19.—HYMEN BIPARTUS OR SEPTUS OR DIVIDED HYMEN.

FIG. 20.—HYMEN SEPTUS IN AN UNMARRIED WOMAN TWENTY-FOUR YEARS OLD. STRONG AND THICK SEPTUM.

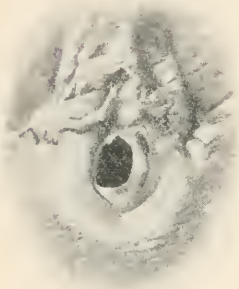


FIG. 21.—LARGE AND SMALL OPENINGS IN A DIVIDED CIRCULAR HYMEN.

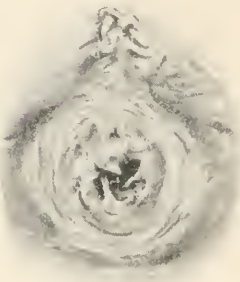


FIG. 22.—CIRCULAR HYMEN OF AN ADULT PAROUS WOMAN.

FIG. 23.—CIRCULAR HYMEN OF VIRGIN, AGE TWENTY YEARS. HYMEN PARTIM SEPTUS.

FIG. 24.—CIRCULAR HYMEN WITH CONGENITAL TRANSVERSE SEPTUM IN GIRL OF SEVENTEEN.

FIG. 25.—DIVIDED HYMEN OF INFANT WITH THICK TRANSVERSE SEPTUM.

FIG. 26.—CIRCULAR HYMEN OF CHILD, AGE TWELVE, RUPTURED BY RAPE. DEATH IN TEN DAYS FROM PERITONITIS.

FIG. 27.—CIRCULAR HYMEN WITH OLD HEALED LACERATION TO LEFT AND RIGHT.

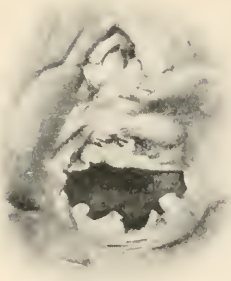


FIG. 28.—REMAINS OF HYMEN SIX MONTHS AFTER DELIVERY AT TERM. CARUNCULÆ MYRTIFORMES.

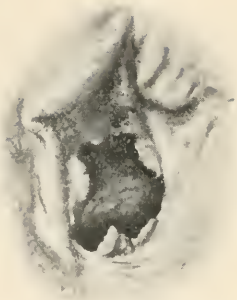


FIG. 29.—HYMEN AFTER SEVERAL LABORS. SHAPE ORIGINALLY CIRCULAR.

FIG. 30.—DIVIDED HYMEN OF A PROSTITUTE EIGHTEEN YEARS OLD. COITUS TOOK PLACE THROUGH THE LEFT OPENING.

FIG. 31.—REMAINS OF A DIVIDED HYMEN AFTER DEFLORATION AND PARTURITION.

FIG. 32.—HYMEN FROM A WOMAN, AGE TWENTY-NINE, WHO DIED IN SIXTH MONTH OF FIRST PREGNANCY. ORIGINALLY A DIVIDED CIRCULAR HYMEN.

FIG. 33.—HYMEN FROM ELDERLY MULTIPAROUS WOMAN.

FIG. 34.—PARENTAL RAPE ON INFANT EIGHT MONTHS OLD. COMPLETE LACERATION OF PELVIC FLOOR.—(*New York Children's Society.*)

FIG. 35.—CONGENITAL ABSENCE OF HYMEN. MASCULINE PSEUDOHERMAPHRODISM. FEMALE INFANT WITH NORMAL INTERNAL AND HERMAPHRODITIC EXTERNAL ORGANS.

genitals, thighs, abdomen, or perineum. The hymeneal tear itself may be attended with pain and difficulty in walking. Attention should be paid to the manner in which the hymen is torn, as well as to the appearance of the edges of the segments. As a rule, healing takes place in from eight to twelve, or at most twenty, days. Rarely the tears of the hymen unite; if they do, a cicatrix may remain. Incomplete recent defloration is usually seen in young children. Non-recent defloration may be told chiefly from the absence of a complete hymen, its remnants only remaining. The vulval canal is likely to be dilated.

Conditions Simulating Defloration.—Traumatism, all ulcerative and gangrenous affections of the pudendum, chancre, chancroid, mucous patches, and herpes progenitalis may each cause such destruction that the results may simulate those caused by intromission. An extreme degree of leucorrhea or an excessive menstrual discharge may cause dilatation of the vagina and superficial ulceration of the mucous membrane, like that produced by coitus. Again, marks of violence must be considered. Stains of blood and semen should be carefully examined. Vaginal discharges must be scientifically considered. Leucorrhea must be differentiated from gonorrhea.

Can a woman be violated against her will? The best authorities believe fully that a mature woman, in full possession of her faculties, cannot be raped by a single man against her will. In the case of a child or an old woman, or when there are two or more assailants, the conditions are very different. Terror may in certain instances cause paralysis. Can rape be accomplished during natural sleep? This is probably unlikely, indeed impossible, in the case of a virgin. Rape by fraud, unfortunately, is widely prevalent, as in the impersonation of a husband. Rape on psychopathic individuals, in the hypnotic state, and during unconsciousness from narcotism, alcoholism, and anesthesia has occurred.

2. Rape upon Children and Infants.—This is far more common than the crime on adults, for it is easier to perpetrate, and there is a wide-spread superstition among some nationalities that intercourse with a virgin is a sure cure for venereal disease. On account of the disproportion between the organs, the crime usually consists in placing the head of the penis between the labia majora or the thighs of the child. There are great differences between the genital organs of the child and the adult. The whole vulval canal is relatively much longer in youth than after puberty. It is important to examine the fourchette and commissure for evidence of rape in children, since, on account of the very small opening, injury is more common in their case than in that of mature women. The hymen is very deeply situated in the child and there is almost no possibility of intromission. The pubic arch, as well as the vagina and its entrance, are very narrow. One of my 600 cases was rape by a father upon his daughter eight months old, causing complete laceration of the perineum from vagina to rectum. The hemorrhage was controlled and the perineum repaired with sutures (Case No. 70,542) (Fig. 34).

G. P.; born in United States; aged eight months; seen February 17, 1893, soon after assault. The external genital organs were found to be greatly swollen, contused, and œdematous. Complete laceration was found to have occurred at the vaginal and rectal orifices, causing loss of tissue between these two orifices and for some distance up on the recto-vaginal septum, so that the vaginal and anal orifices appeared as one, surrounded by a bleeding mass of lacerations. The child was removed to a hospital and an operation requiring the introduction of several sutures was necessary to control the bleeding and partially to repair the torn parts and restore them to their original condition. Defendant in this case was charged with attempt at rape, pleaded not guilty, was adjudged insane, and committed to the State Asylum for Insane Criminals at Matteawan.

3. Rape by Boys and Women.—Erections are known to be possible at four

years of age, although both in this country and in England a boy under seven years cannot legally commit a felony. Rape by women, or rape by females on males, is not uncommon. It is generally committed by an adult woman to gratify a perverted sexual instinct, or while in a state of nymphomania. There is a superstition among the ignorant that the act will cure venereal disease.

4. Rape on the Dead, or Necrophilia.—This subject must not be confused with that which deals with the evidence of rape found on the dead body, the crime having been committed before death. The history of this revolting deed extends back through the ages. In the State of New York this crime is punishable by the maximum penalty of twenty years of imprisonment.* Physical evidence of it would be difficult if it were not seen. Several instances of this crime occurred in the old New York city morgue.

Statistics.—In my study of 600 consecutive examinations for evidence of rape made in New York, for the Society for the Prevention of Cruelty to Children, I obtained the following statistics: *Age:* The youngest child was eight months, the oldest eighteen years, and the average age was eleven years. *Nativity:* 405, or 67.50 per cent., were native born; 65, or 10.83 per cent., were Italians; 36, or 6 per cent., were Germans; 23, or 3.83 per cent., Russians; 13, or 2.16 per cent., English; 10, or 1.66 per cent., Austrians; 8, or 1.33 per cent., Irish; 4, or 0.66 per cent., Scotch; 4, or 0.66 per cent., Swiss; 4, or 0.66 per cent., Hungarians; 3, or 0.50 per cent., French; 3, or 0.50 per cent., Belgian; and 2, or 0.33 per cent., Bohemian. *Marks of a struggle:* I found marks of a struggle in only 15 cases, or 2.50 per cent. These included abrasions, contusions of the thighs, groins, buttocks, shoulder, and arm, 11 cases, or 1.83 per cent.; scratches of the hand and face, 3 cases, or 0.50 per cent.; and black eye in 1 case, or 0.17 per cent. *Condition of the external genitals:* Contusions, abrasions, or lacerations were present in 21 cases, or 3.60 per cent.; vulvo-vaginal abscess in 1 case, or 0.17 per cent.; chancres or chancroids in 18 cases, or 3.01 per cent.; the fourchette was lacerated in 17 cases, or 2.83 per cent. The hymen was found to have been ruptured in 338, or 57.46 per cent. of cases; inflamed in 7 cases, or 1.19 per cent.; stretched in 11 cases, or 1.83 per cent.; contused in 1 case, or 0.17 per cent.; and abraded in 2, or 0.33 per cent. of cases. *Secretions:* A muco-purulent or purulent discharge was found in 67 cases, or 11.16 per cent.; the gonococcus was found in 16 cases, or 2.66 per cent.; and spermatozoa in 2, or 0.33 per cent. *Impregnation,* as far as the cases could be followed, was known to have occurred in 22, or 4 per cent. Undoubtedly this is a low percentage, as many cases passed from observation. *Penetration* of the genital organs by a blunt instrument was considered to have been recent in character in 201, or 33 per cent.; non-recent, in 180, or 30 per cent., and both recent and non-recent in 5 cases. Penetration was thus determined in 386 cases, or 65 per cent. In 2 cases, because of menstruation and venereal sores, it was impossible to determine whether penetration had occurred or not. This leaves 212 cases, or 35 per cent., in which there was no evidence whatever of penetration of the genital organs.

VI. HYGIENE OF THE SEXUAL FUNCTIONS.

The health of the young girl should be most carefully guarded with a view of preserving the integrity and vitality of the sexual functions. The difference in vigor between the American women and their English and Continental sisters points strongly to the superiority of the habits of life of the latter. The vulnerability of the female pelvic organs is well known, and most of the dangers attending their treatment in former times have been done away with by modern aseptic technique. The causes of gynecological disease are (1) predisposing and (2) exciting. Chronologically considered, the first predisposing cause is heredity.

Heredity.—The untoward results of this factor are seen either in the direct transmission from mother to daughter of specific physical defects, or in general ill health as the heritage of ill-conditioned parents. It is generally accepted that

* Rust's "New York Penal Code and Criminal Procedure," 1891, chap. v, p 63, sec. 303, clause 4.

the children of parents of advanced years are apt to be less vigorous than those of younger progenitors.

Education.—This has a powerful influence on the genital functions. Great concentration in study uses up the nerve energy of the body and leaves the uterus and ovaries without their legitimate share. Especially does close application to music have a deleterious effect on these functions, by its emotional influences and the expenditure of nervous energy which it demands. Hyperemia of the pelvis, however caused, tends to produce disease of its contained organs. Sexual excitement produced either through mental or physical influences—*e. g.*, the observation of obscene sights or pictures, or masturbation—is also a cause.

Mode of Life.—Lack of exercise and of outdoor air is a fruitful cause of disease and poor pelvic circulation. In the last few years attention has been called to these defects in the life of the average American girl, and athletic sports, comparing favorably with those of men, have been instituted. Neglect of the skin as the medium for so much of the vitiated excretions of the body is particularly noted among the poorer class of foreigners. The amount and kind of food exercises an important influence on the young girl's health. A common habit, which grows stronger with every repetition, is the omission of breakfast. Soda-water, ice-cream, and candy are most harmful if taken to excess, as they very often are. Indigestible and non-nutritious foods should be avoided. All these factors tend to produce anemia and general ill health. Neglect of the excretions is a very common fault in young girls, as well as in women, and especially those with gynecological troubles. The bowels, instead of moving once or twice a day, as they should normally, are evacuated perhaps once a week. The poisons of the waste matter are absorbed and sapremia results. The circulating impurities show themselves in the anemic appearance, lack of energy, headache, and neuralgic pains. Then, again, the bladder is often not emptied when it should be; consequently distention and displacement of the uterus by the enlarged bladder, or paralysis of that organ, or cystitis may result. Disregard of the menstrual periods causes much trouble. Girls during these periods are very apt to make no difference in their manner of life from that at any other time. Oftentimes violent exercise and exposure at these periods bring on serious consequences.

Dress.—The manner of dressing has much to do with health or disease; it is especially faulty amongst women. Tight garments for any part are most injurious. The disproportionate arrangement of clothes as to the warmth they afford is injurious; for instance, when the lower abdomen is not sufficiently protected. Incorrect corsets exert a most baneful effect on the female organism. The old-fashioned garment, even when worn loose, exerts a pressure of thirty pounds (Fig. 36). The abdomen suffers from this more than the thorax. There is a thinning and weakening of the abdominal wall, which becomes relaxed and pushed forward in the upright position, by the liver and intestines. In the sitting posture, the pressure exerted by the abdominal wall, which should be backward against the spine, is exerted downward toward the pelvis, and causes bulging of the vulva even to the extent of half an inch (1.27 cm.). Corsets made to support the lower abdomen have not these objections (Fig. 37). High heels should be avoided, for when they are worn, especially by the young, whose bones and articulations are soft and pliable, they not only distort the foot but often engender other troubles, such as neuralgic pains in the legs, alterations in the shape of the pelvis, and curvature of the spine. Ordinary social pleasures entailing late hours have a very bad effect on a girl's nervous organization.

Sexual Life.—Normal sexual intercourse, even when frequent, is not apt to

injure a healthy woman. But irregularities indulged in will bring in their train many complaints. Marriage, if pelvic disease exists, is often attended with dire results, and causes much misery to both husband and wife. The growth of fibromata seems especially active in the uteri of unmarried women and in those who have never borne children. It would seem that the energies of that organ, which are normally applied to the formation of a child, being deprived of that object, are free to take part in the production of a new growth.

The Prevention of Reproduction.—The act of reproduction may be set at naught in a twofold manner: (1) By conditions which prevent the union of the

FIG. 36.—CORSET IMPROPERLY FITTED, SO THAT ABDOMINAL CONTENTS ARE PUSHED DOWNWARD AND BACKWARD, THUS FAVORING POSTERIOR UTERINE DISPLACEMENTS. Note the unnatural pressure upon the breasts.—(*Photographed from life.*)

FIG. 37.—PROPERLY FITTING CORSET. HYPOGASTRIUM SUPPORTED FROM BELOW UPWARD. BREASTS FREE AND ONLY THEIR LOWER PORTIONS SUPPORTED.—(*Photographed from life.*)

reproductive units, and (2) by death of the embryo which results from the union of these units.

1. NON-IMPREGNATION.—When non-impregnation comes about solely through conscious efforts of the participants, we have a condition of affairs known as artificial sterility, a subject which has a distinct obstetrical significance, because in order to save the lives of certain women, and at the same time to avoid feticide, it is justifiable to prohibit impregnation. Unless either the life or the health of the woman is certain to be wrecked by bearing a child, or unless she is incapable of giving birth to a normal living child, the prevention of impregnation is justly regarded as a violation of the moral law, an injury to the State, and to a certain extent a detriment to the health of the participants. Technically, at least, it is a

violation of the criminal code, the various contrivances used for the prevention of conception being regarded as contraband. A sharp distinction should therefore be made between artificial sterility which is practised to save the more valuable life, and that which simply seeks to prevent reproduction in itself.

Therapeutic Prevention.—This expression signifies the prevention of impregnation in cases in which the reproduction of a healthy, living child is quite impossible, or if possible would mean either the death or permanent invalidism of the mother.

Indications.—These comprise: (1) General conditions in the mother which are likely to be transmitted to the child—syphilis, the tuberculous dyscrasia, insanity, epilepsy. (2) General conditions in the mother which would be aggravated to such an extent by reproduction that her death would be determined, or, if inevitable in any case, greatly accelerated—heart disease, tuberculosis, cancer, nephritis, diabetes, etc. (3) Conditions in the mother which, by producing extreme dystocia, would make Cæsarean section the only route by which the child could be born—high degrees of contracted pelvis, obstruction of the birth tract by inoperable tumors.

Management.—In the case of a woman who furnishes any of the indications just enumerated, it is the duty of the physician to inform the patient and her husband of all the consequences of impregnation under the circumstances. If the matter is left to him to decide, he must insist that conception shall not occur. Much further than this he can hardly go. Realizing that cohabitation without intercourse is a condition difficult to realize, he may suggest a separation, temporary or not. If this is refused, coitus might be permitted during the so-called agenetic period of the intermenstrual cycle (from the seventeenth to the twenty-fourth day after cessation of a period). The married pair should be informed that this precaution simply diminishes the risk, and that if the latter is assumed, impregnation, if it occur, will necessitate interruption of the pregnancy, which will submit the mother to more or less danger, hardship, expense, etc. If the matter is left to the physician, he can hardly sanction coitus under any circumstances. Sooner or later the question will arise as to the use of so-called illegitimate measures of preventing conception. If asked the objections to these, he must take the stand that every one of these preventive measures constitutes an abuse of a normal function. The coitus interruptus, coitus reservatus, simple or antiseptic douching after coitus, wearing of coverings for the penis or obturators for the uterus, etc., are all unphysiological and many of them untrustworthy. A physician can never sanction anything which is frankly unphysiological, and should explain to his patients that the act of intercourse consists in three distinct stages: (1) The male organ becomes completely rigid, passing from a state of flaccidity into erection. (2) The second stage comprises intromission, friction, and the orgasm or crisis. (3) The act of copulation is not concluded by the orgasm. The penis, therefore, should not be withdrawn at once, but allowed to remain until the gradual subsidence of the erection leaves it in its original flaccid state. This final stage of copulation undoubtedly plays an important rôle in impregnation, and if it is shortened or omitted, the consequences appear to be unpleasantly felt by both sexes. In other words, withdrawal of the penis immediately after the orgasm is virtually a coitus interruptus. It is characteristic of the various illegitimate measures for preventing conception that all of them interfere with the second or third stage of coitus. The consequences to the woman of these illegitimate practices are in part: (1) An unnatural local congestion which leads to oöphoritis, endometritis, leucorrhea, dysmenorrhea, sterility, metrorrhagia, and cancer of the uterus; (2) neuroses of various kinds,

spinal irritation, neurasthenia, etc. In the man the consequences are similar in character, with the addition of dissatisfaction with imperfect coitus with his wife, which often foments dislike, unfaithfulness, marital infelicity, and divorce. If impregnation is actually contraindicated in a given case, the practitioner cannot recommend any of the illegitimate modes of prevention of conception because they are either harmful, or untrustworthy, or both. There is, however, one course possible, which may be recommended as both safe and efficacious, and one which can hardly be abused. That is, obliteration of the Fallopian tubes for a short extent by the vaginal route.

This course is unobjectionable in theory from any standpoint; yet I fear it hardly constitutes a solution to the problem.

2. Interruption of Pregnancy.—After pregnancy has begun it may be interrupted by the natural death of the fetus from disease, trauma, etc. This is considered under the heads of death of the fetus, abortion, etc. (Part III). Pregnancy intentionally ended is feticide. Criminal feticide is the destruction of fetal life for no other reason than to avoid child-birth. This is considered under the head of criminal abortion (Part III). Therapeutic feticide, on the contrary, consists in taking the fetal life when non-interference with pregnancy would result in the death or permanent invalidism of the mother, or the birth of an abnormal unit of society. The subject of therapeutic feticide is considered under "Obstetric Operations" (Part X).

Child-birth.—Child-birth not infrequently is the origin of disease of the pelvic organs, which hinders or prevents their normal functions. These troubles may or may not result from improper medicinal or surgical treatment. Abortion is a fruitful cause of pelvic trouble. Puerperæ should receive the most careful attention, and should be kept in bed till the uterus has contracted back into the pelvis. In order to avoid the perils of gonorrheal and syphilitic infection, these subjects are now receiving like attention with tuberculosis. The application of the general principles of aseptic midwifery and early operative measures in case of delayed labor, with immediate surgical attention given to lesions of the soft parts, are doing much to prevent the frequent pelvic troubles so common in former years.

Climacteric.—The climacteric, although a physiological process, is a period during which various diseases may show themselves. Nervous phenomena are among the most common disturbances. The most serious occurrence is the appearance of carcinoma, either in the uterus or in the breast. During this period the bowels should be kept open. Cold bathing followed by brisk rubbing, and lukewarm baths taken at intervals of a few days, tend to calm the nerves. The diet should be carefully supervised. The patient should be supported mentally and encouraged by a favorable prognosis. In case of hemorrhage, it should be checked just as in ordinary cases.

Cancer.—There is little possible prophylaxis at present for malignant disease of the pelvic organs, but there is hope for the future. As soon as the true cause of cancer is discovered, some method of preventing or at least arresting its progress will present itself.

Family Physician.—The family physician should be the guide of the child from infancy through the various stages of life up to womanhood. He should instruct not only the girl, but her mother also, in regard to the importance of the sexual organs, their functions, and their proper care. The generative organs are the last to develop, and when the girl is deficient in vitality these organs are the first to suffer, for when undeveloped they are most prone to disease.

PART TWO.

Physiological Pregnancy.

I. PHENOMENA PRODUCED BY PREGNANCY WITHIN THE UTERUS. (Page 41.)—The Ovum; Maturation; Fertilization; Primitive Chorion; Deciduæ; Segmentation; Germ-layers; Primitive Organs; Origin of Membranes; Amnion; Allantois; Chorion; Placenta; Umbilical Cord; Nutrition and Metabolism of the Ovum, Embryo, and Fetus; Characteristics during the Several Lunar Months; Evolution and Determination of Sex.

II. PHENOMENA PRODUCED BY PREGNANCY IN THE MATERNAL ORGANISM. (Page 89.)—Local Phenomena in the Genital Tract, Adnexa, Pelvis, and Breasts; General Phenomena in the Digestive System, Heart, Lungs, Liver, Nervous System, Blood, Urine, Skin, etc.

III. THE DIAGNOSIS OF PREGNANCY. (Page 119.)

IV. THE DIFFERENTIAL DIAGNOSIS OF PREGNANCY. (Page 132.)

V. FEIGNED PREGNANCY—PSEUDOCYESIS. (Page 138.)

VI. UNCONSCIOUS PREGNANCY. (Page 139.)

VII. MULTIPLE PREGNANCY. (Page 140.)

VIII. THE DURATION OF PREGNANCY. (Page 144.)

IX. CALCULATING THE DATE OF CONFINEMENT. (Page 146.)

X. THE EXAMINATION OF PREGNANCY. (Page 148.)—Obstetric Asepsis of Patient and Physician; Objects, External or Abdominal; External Pelvimetry; Internal or Vaginal; Internal Pelvimetry; Röntgen Pelvimetry; Pelvigraphy; Indirect Pelvimetry; Cliseometry; Cephalometry.

XI. THE HYGIENE AND MANAGEMENT OF PREGNANCY. (Page 184.)—Prophylaxis; Exercise; Diet; Drink; Bowels; Fresh Air; Care of Skin, Clothing, Breasts; Mental Condition; Examination of Urine; Sexual Intercourse.

I. THE PHENOMENA PRODUCED BY PREGNANCY IN THE UTERUS. THE DEVELOPMENT OF THE OVUM, EMBRYO, FETUS, FETAL MEMBRANES, AND FETAL STRUCTURES.

Introduction.—Pregnancy begins with conception and normally ends with labor at the fortieth week. If no complications arise during this time, we have a physiological pregnancy (Part II). On the other hand, various accidents may bring about a pathological pregnancy (Part III).

A *nulliparous* woman, or a nullipara, is one who has never borne a child, and the condition is one of *nulliparity;*

A *primigravidous* woman, or a *primigravida* (or primipara), is one who is pregnant for the first time, and in subsequent pregnancies she is known as a *multigravidous* woman or a *multigravida* (or multipara). Different degrees of *gravidity* or *parity* are usually designated by the Roman numerals, thus: Ipara, a woman in her first pregnancy; IIpara, one in her second pregnancy; IIIpara, IVpara, Vpara, etc.

In the following review of the subject of embryology, emphasis is placed upon the growth of the embryo, fetal membranes, and fetal circulation—facts which bear most directly upon the subject of obstetrics. For a full consideration of the subject special works on embryology should be consulted. Among these, Minot's discussions of difficult points are valuable, while the most recent book with an almost exclusive bearing upon human embryology is Kollmann's "Entwickelungsgeschichte der Menschen." The embryological part of Quain's "Anatomy" and Hertwig-Mark's "Embryology" also give excellent accounts of the subject. For the latest information one must refer to the monographs which are appearing in scientific periodicals. His's monumental work* is the source of the greater portion of the accurate information on the subject of human embryology. The phenomena of the development of the human being in its earliest stages have not been adequately worked out; hence the gaps in knowledge are usually filled in by statements from comparative embryology. We shall endeavor to differentiate what is known of human development from that which is inferential.

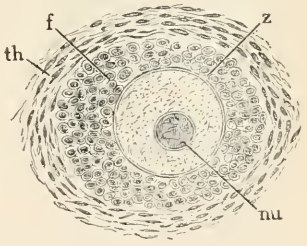


FIG. 38.—PRIMITIVE FOLLICLE FROM THE OVARY OF A WOMAN THIRTY-TWO YEARS OLD. *th*, Connective-tissue layer; theca folliculi; *f*, epithelial follicle; *z*, beginning zona pellucida; *nu*, nucleus or germinative vesicle.—(*After W. Nagel.*)

The Ovum.—At birth the ovary of a child is believed to contain the maximum number of ova, estimated as high as 70,000. These primordial ova are typical, spherical cells containing a nucleus with a membrane and one or several nucleoli (Fig. 38). They are arranged in so-called egg-tubes of Pflüger and egg-nests (Fig. 39), which extend for some distance into the body of the ovary. By the gradual ingrowth of vascular connective-tissue between the individuals of the tubes and nests the ova are separated and become entirely surrounded by a connective-tissue sheath, the theca folliculi. Thus are formed the primitive follicles which at a later stage

* "Anatomie menschlicher Embryonen," 1880–1885.

of development are known as Graafian follicles (Fig. 1). As the ova develop they increase in size until at maturity they are about $\frac{1}{125}$ inch (0.2 mm.) in diameter, surrounded by a porous membrane, the zona pellucida or radiata; this in turn is surrounded by a several-layered follicular epithelium known as the corona radiata. A cell membrane limits the ovum proper, between which and the zona pellucida there exists a narrow fissure known as the perivitelline space.

The cell body, or vitellus, is protoplasmic and contains a few granules of food-yolk similar to that which forms so marked a feature of the hen's egg. On account of this small amount of food-yolk, or deutoplasm, the mammalian egg is said to be alecithal (without yolk), in contradistinction to telolecithal eggs, as best exemplified by Amphibia and birds, where the nutritive yolk is massed

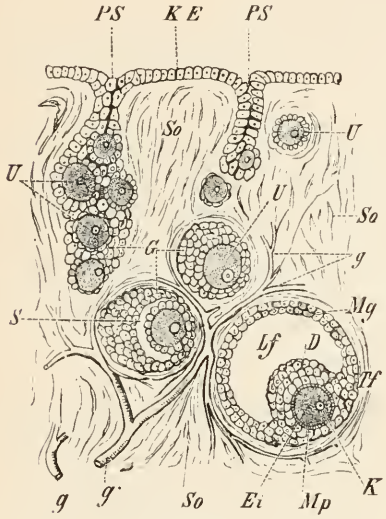


FIG. 39.—DEVELOPMENT OF GRAAFIAN FOLLICLE OF MAMMALS. *D*, Cumulus oöphorus; *Ei*, ripe egg with its germinative vesicle and germinative spot (*K*); *Ke*, germinal epithelium; *Lf*, liquor folliculi; *Mg*, stratum granulosum; *Mp*, membrana pellucida; *Ps*, Pflüger's tubes; *S*, fissure between follicular cells (*G*) and cumulus oöphorus; *So*, connective-tissue stroma with blood-vessels (*g*); *Tf*, theca folliculi; *V*, *V*, primitive follicles.—(*After Wiedersheim.*)

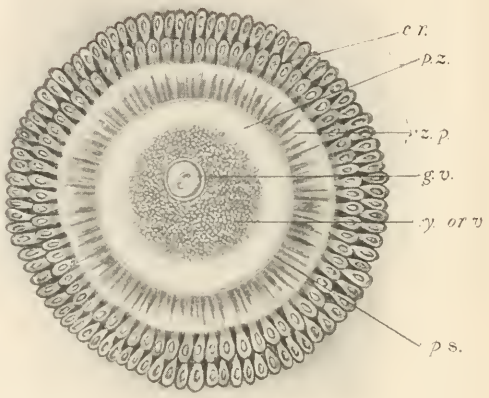


FIG. 40.—FULL-GROWN HUMAN OVUM BEFORE MATURATION. A spherical cell with nucleus, nucleolus, and yolk granules. *z.p.*, Zona pellucida; *y.* or *v.*, yolk or vitellus; *g.v.*, germinal vesicle with nucleolus; *cr.*, corona radiata; *pz.*, protoplasmic zone of ovum; *p.s.*, perivitelline space.—(*After Nagel.*)

at one pole; and centrolecithal eggs, as exemplified by Arthropods, where the deutoplasm has a central position.

The nucleus becomes somewhat eccentrically placed and contains a conspicuous nucleolus (Figs. 1 and 40). The whole ovum is encapsuled by the Graafian follicle. The follicles are scattered at different levels throughout the stroma of the ovary (compare Ovulation, page 17).

Maturation of the Ovum and Zoösperm.—In many of the lower animals a process called maturation of the ovum has been observed, whereby the nucleus migrates toward the surface and by an active process of division throws off a part of its substance in the form of polar globules, the part remaining in the cell being called the female pronucleus or egg nucleus.

Polar bodies in different stages of development have been found in the eggs of mammals (Figs. 41 and 42), and we may reasonably infer that a similar process transpires in the human ovum. As the result of a somewhat analogous process of maturation and division, the zoösperm or mature male element (Fig.

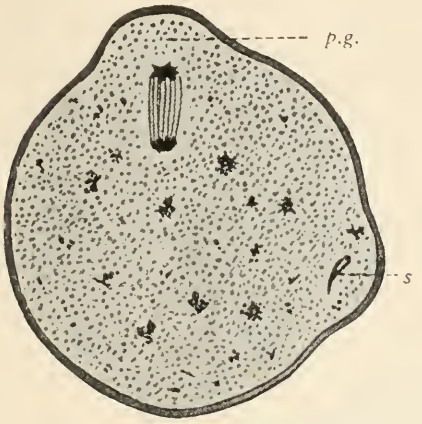


FIG. 41.—FORMATION OF POLAR GLOBULES, MOUSE. Showing the nucleus of the ovum dividing to form the first polar globule, *p.g.*, and at the right a zoösperm, *s*, which has entered at the projecting portion.—(*After Sobotta.*)

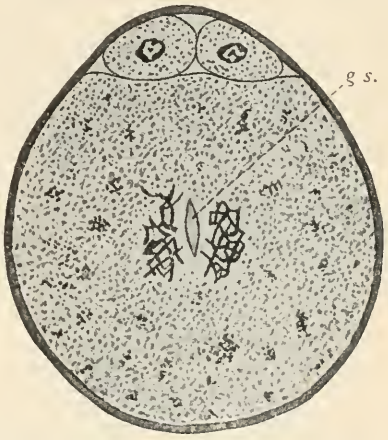


FIG. 42.—FERTILIZATION IN THE MOUSE. Showing an ovum with two polar globules and the male and female pronuclei about to unite; *g. s.*, achromatic spindle.—(*After Sobotta.*)

FIG. 43.—OVUM OF WHITE MOUSE. First segmentation spindle with the chromosomes of the pronuclei still forming two distinct groups. × 1500 diams.—(*After Sobotta.*)

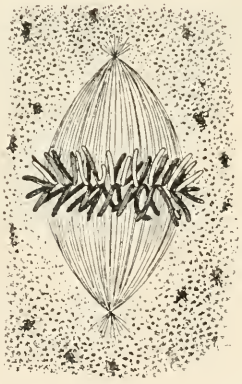


FIG. 44.—OVUM OF WHITE MOUSE. First segmentation spindle with equatorial plate of chromosomes. × 1500 diams.—(*After Sobotta.*)

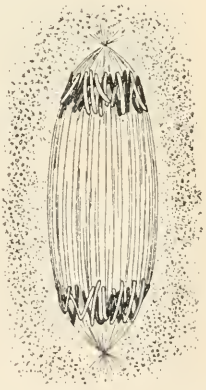


FIG. 45.—OVUM OF WHITE MOUSE. First segmentation spindle. The chromosomes have divided and migrated toward the poles of the spindle, forming two groups. × 1500 diams.—(*After Sobotta.*)

8) contains a nucleus,—the male pronucleus, or sperm nucleus,—which represents only a part of the original nucleus from which it was derived.

Fertilization or Impregnation.—When the two sexual elements come in contact in the upper part of the Fallopian tube, the zoösperm enters the ovum, where its body becomes indistinguishable (Fig. 42), and a union of the two

pronuclei takes place. This is considered the essential step in fertilization, the union giving rise to a new nucleus called the segmentation nucleus. In the ovum of the white mouse, according to Sobotta, the pronuclei never actually fuse to form a membranate segmentation nucleus. Here the pronuclei lie first in close apposition and are then separated by the formation of the achromatic spindel (Fig. 42).

The pronuclei now break up into chromosomes and arrange themselves first into two groups about the spindle (Fig. 43) and then into an equatorial plate (Fig. 44). At this stage there occurs a longitudinal splitting of the chromosomes and a consequent doubling of their original number. The chromosomes next draw apart toward the two poles of the spindle (Fig. 45), where, after the completion of the first segmentation, they give rise to the nuclei of the resulting cells. It is now believed that a similar process of fertilization takes place in all mammalian ova. Facts of this sort have great bearing upon theories of heredity, because it is evident that the actual substance derived from both parents goes to form the new individual and apparently is distributed by subsequent nuclear division to every portion of the body (see Impregnation, page 29).

FIG. 46.—TRANSVERSE SECTION OF THE UTERUS FROM A SIX-MONTHS' FETUS AT THE LEVEL OF THE INTERNAL OS. 1, Cylindrical ciliated epithelium; 2, connective-tissue stroma of mucous membrane containing blood-vessels, 3, muscular layer with arteries; 4, subserous connective tissue; 5, peritoneal endothelium; 6, intraligamentary connective tissue, containing main branches of uterine artery.—(*Schaefer.*)

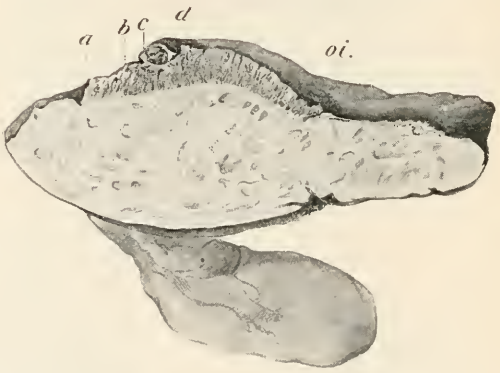


FIG. 47.—UTERUS AND OVUM AT SEVENTH OR EIGHTH DAY. SECTION THROUGH FIG. 48. *a*, Decidua vera; *b*, *d*, decidua reflexa; *c*, ovum; *o.i.*, internal os.—(*Leopold.*)

Primitive Chorion.—During its passage through the Fallopian tube the ovum derives more or less nourishment from the parts by which it is surrounded. This is accomplished at a very early period by the formation upon all of the extra-embryonic somatopleure of a growth of delicate villi which give to the ovum even at this time a shaggy appearance. This is the primitive chorion, and the whole ovum at this time is called the chorionic vesicle.

The Deciduæ.—The uterus prepares for the reception of the fertilized ovum by the premenstrual swelling of its mucosa which forms a pulpy nidus for its new occupant. If the fertilized ovum does not then appear, menstruation takes place. If the fertilized ovum remains in the genital tract, then the uterine

mucosa undergoes changes by which it is converted into decidua. That formed in pregnancy is called *decidua graviditatis*. The normal uterine mucosa is thin, averaging from 0.039 to 0.117 inch (1 to 3 mm.) in thickness. Its most marked change in pregnancy is the increase in this dimension, for in this condition it often attains $\frac{7}{8}$ inch (1 cm.) in thickness. It is very vascular, soft and velvety in consistence, and its surface is wavy or undulating, studded with depressions which correspond to the openings of glands. With the beginning of pregnancy the decidua comprises three parts: (1) *Decidua vera* is the hypertrophied mucous membrane of the entire uterus (Figs. 47, 48, and 49). It atrophies in the last third of pregnancy and is cast off in part with the membranes at labor and in part with the lochia. (2) *Decidua serotina*, placental serotina or decidua basilis, is that part of the decidua vera upon which the ovum is embedded and which subsequently takes part in the formation of the placenta (Fig. 47). (3) *Decidua reflexa*, circumflexa or capsularis, or epichorial decidua, is not, as its original name indicates, reflected, but is formed by growth of the uterine tissues over the ovum till they meet above its surface (Figs. 47 and 49). This

FIG. 48.—UTERUS AND OVUM AT SEVENTH OR EIGHTH DAY, SHOWING DECIDUA VERA. *o.i*, internal os; *a*, uterine wall.—(*Leopold.*)

process of reflexion is nearly completed in the youngest human ovum, Peters's (Fig. 51), and is quite finished in from eight to twelve days after the migration of the ovum into the uterus. The capsule grows with the increase of the ovum until the second month, when it begins to degenerate, disappearing entirely by the seventh month (Fig. 53).

Theories of the Origin of the Decidua.—There have been various theories concerning the decidua. In 1840 Weber and Sharpy demonstrated glands within it and showed it to be a hypertrophied mucosa. Friedländer's ideas concerning the structure of the decidua are, in general, correct. He found therein glands lined by high, columnar, ciliated epithelium. The decidua vera comprises two layers; the upper layer, or stratum compactum, consisting of decidual cells with gland ducts here and there, while the attached layer, or stratum spongiosum, is of spongy consistency, and made up of a few decidual

cells, blood-vessels, and dilated glands or cavities. Friedländer believed that at the end of pregnancy the compact layer is thrown off; while there is left the

FIG. 49.—MICROSCOPIC SECTION THROUGH AN OVUM IN SITU AT THE SEVENTH OR EIGHTH DAY, SHOWING UTERINE WALL, DECIDUA VERA AND REFLEXA.—(*Leopold.*)

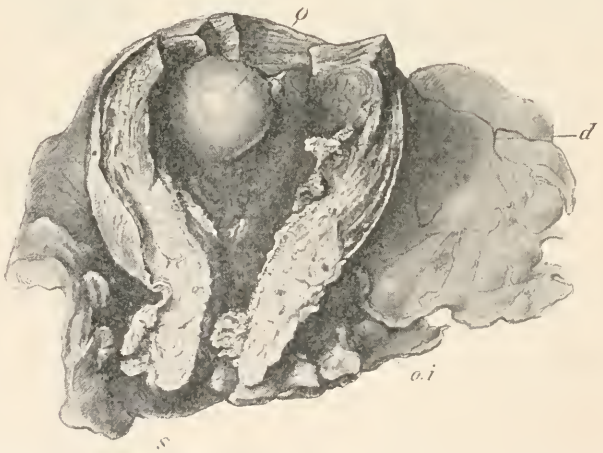


FIG. 50.—UTERUS AND OVUM AT TWO WEEKS. *o*, Ovum; *d*, decidua vera; *o.i.*, internal os; *s*, external os.—(*Leopold.*)

spongy layer, which is the dilated, irregular surface usually seen. It is now known that the line of demarcation is somewhat deeper than Friedländer believed. His work has been verified by Leopold and Meinert.

FIG. 51.—SECTION OF PETERS'S OVUM IN SITU. *Am.c*, Amniotic cavity; *bl.lac.*, blood lacuna; *clot*, blood-clot on surface of the uterus; *Cœ*, extra-embryonic cœlom; *Conn*, connective tissue of uterus; *Ec*, ectoderm of chorion; *Ep*, epithelium of uterus; *Mes*, mesoderm of chorion; *Sh*, embryonic shield; *Tro*, trophoblast; *Vi*, mesodermic core of chorionic villus; *Yk*, cavity of yolk-sac.—(*After H. Peters.*)

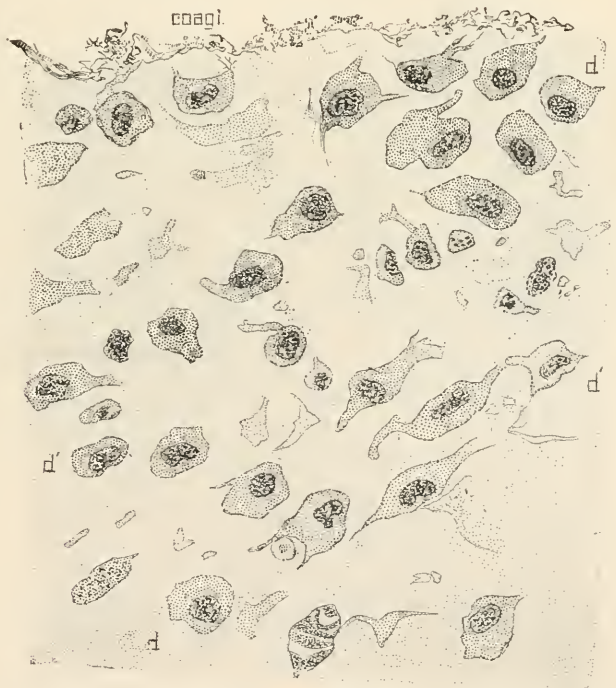


FIG. 52.—UTERUS ONE MONTH PREGNANT; PORTION OF THE COMPACT LAYER OF THE DECIDUA SEEN IN VERTICAL SECTION. *coagl*, Coagulum upon the surface; *d*, *d'*, decidual cells. × 445 diams.—(*Minot.*)

The Decidual Cell.—The origin of the decidual cell, discovered by Hegar and Maier about 1860, though variously explained, is now known to be the connective-tissue cell. It is much larger than the cell of the interglandular substance and is often very irregular in shape. The hypertrophied decidual cell (Fig. 52) resembles the epithelioid cell of tuberculosis and the lutein cell. It also resembles the large sarcoma cell, and, according to Ruge, is the physiological type of this pathological unit. The hypertrophied decidua, the spongy layer in the early months of pregnancy, may look like malignant adenoma.

Formation.—The formation of the decidua is not dependent on the presence of the fertilized ovum, for we find it in the extrauterine pregnancy. This condition is not absolutely pathognomonic of pregnancy, for the decidual cell is found in endometritis and membranous dysmenorrhea, in which latter affection a cast of the uterus is thrown off. The development of the decidual cell

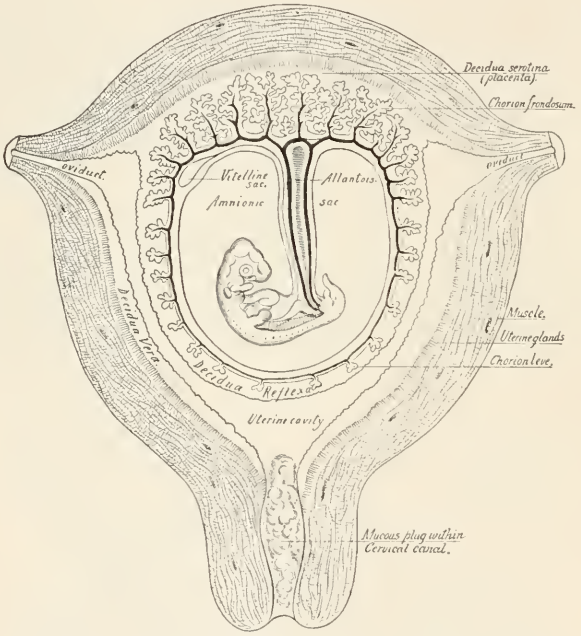


FIG. 53.—DIAGRAM SHOWING THE RELATIONS OF THE UTERUS, EMBRYO, AND EMBRYONIC STRUCTURES AT THE SECOND MONTH OF GESTATION.—(*After Allen Thompson.*)

from the connective tissue of the stroma of the uterus, and that of the lutein cell from the connective tissue surrounding the ovum, are analogous processes. In the ovary they tide over the reconstruction period, while in the uterus they help to form the placenta, and after the birth of the child they are cast off.

Disappearance.—The decidua vera is thickest at the third month of pregnancy, after which it steadily becomes thinner (Figs. 105 and 137). In early pregnancy the ovum does not completely fill the uterine cavity, but when this comes about the decidua vera is compressed and begins to atrophy, while the decidua reflexa comes into closer and closer contact with it, until about the sixth month, at which time the two deciduæ cannot be distinguished. At term the vera is not much thicker than the original mucous membrane. Until the period of fusion of these two parts of the decidua, the interval between them is filled with hydroperione, a mucous liquid much like the liquor amnii. During

the later months of pregnancy the decidua undergoes a fatty degeneration that assists in loosening its attachment to the uterus, and, as already stated, the greater part of this membrane is cast off during labor. Its remains are discharged with the lochia, save a very little that stays behind to assist in the production of a new uterine mucosa (compare Physiologic Puerperium).

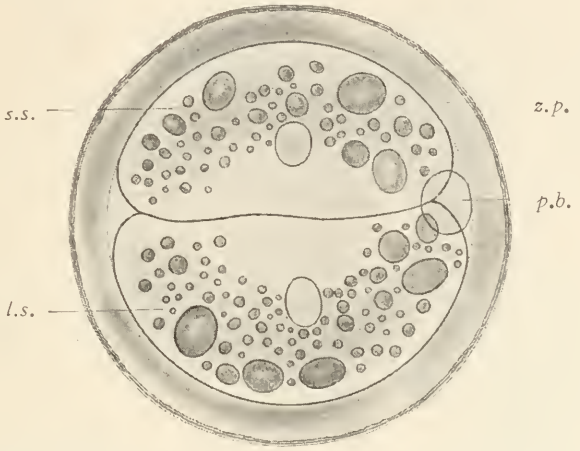


FIG. 54.—SEGMENTATION OF A MAMMAL, BAT. TWO-CELLED STAGE. Two segmentation spheres each having a nucleus. The dark bodies are yolk granules. *s.s.*, Smaller segmentation sphere; *l.s.*, larger segmentation sphere; *z.p.*, zona pellucida; *p.b.*, polar globule.—(*After E. van Beneden.*)

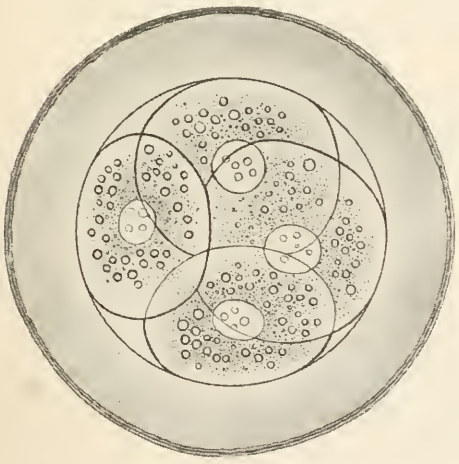


FIG. 55.—SEGMENTATION OF THE OVUM, RABBIT. FOUR-CELLED STAGE.—(*After van Beneden.*)

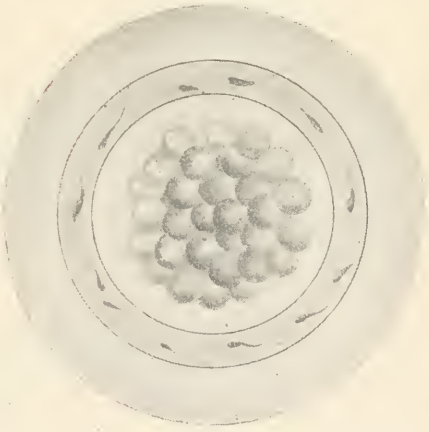


FIG. 56.—SEGMENTATION OF THE OVUM, RABBIT. MANY-CELLED OR MORULA STAGE. Numerous spermatozoa lie in the thickened egg membrane.—(*After Bischoff.*)

Segmentation.—In the human ovum nothing is known of the process by which a single cell subdivides into many. In lower vertebrates and several mammals the process has been carefully followed. In the latter, the segmentation-nucleus divides, thus forming two cells which again divide. These four again divide, and the process of subdivision is continued until a solid ball of cells is

formed, the early blastula or morula, so called rom its resemblance to a mulberry (Figs. 54, 55, and 56). In Amphioxus and some other lower forms the morula

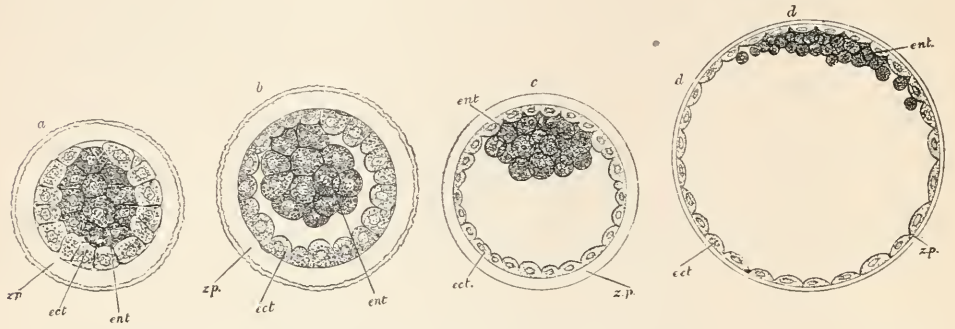


Fig 57.—Segmentation of the Ovum. Sections of the Ovum of the Rabbit During the Later Stages of Segmentation, showing the Formation of the Blastodermic Vesicle. *a*, Showing the outer layer and the inner cell mass before the formation of a cavity; also the so-called blastopore *; *b*, showing the cavity formed by the absorption of liquid; *c*, enlarged cavity; *d*, showing the cell mass forming a layer at one side of the thinned outer or Rauber's layer; *ent.*, inner mass of cells; *ect.*, outer or subzonal layer. When the ovum attaches itself to the uterine wall, this layer becomes the trophoblast; *z.p.*, zona pellucida.—(*After van Beneden.*)

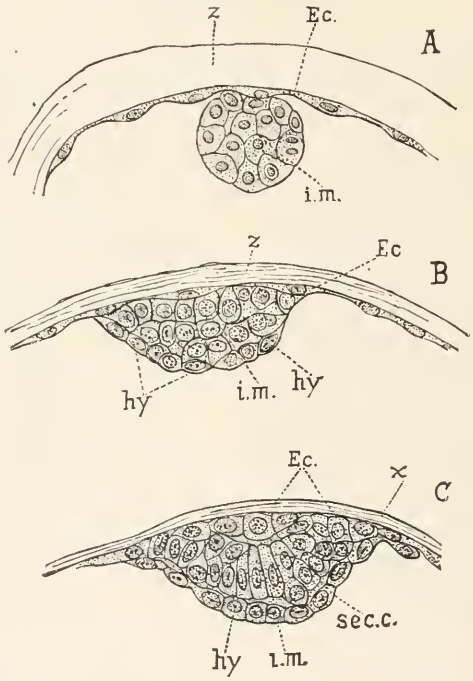


Fig. 58.—Formation of the Blastodermic Layers in the Mole in Three Successive Stages. *z*, Zona pellucida; *e.c.*, subzonal epithelium (ectoderm); *sec.c.*, segmentation cavity; *hy.*, hypoblast; *i.m.*, inner mass of cells.—(*Minot.*)

by further division of its cells is converted into a blastula, which by the process of invagination at the vegetative pole becomes a gastrula (Fig. 59).

* Minot thinks that van Beneden erred in his interpretation of the interruption in the outer or subzonal layer, and believes that it is really a continuous layer of cells.

Such a total division of cells is called holoblastic, to distinguish it from meroblastic division, or such as takes place in a chick, in which a partial division of the egg occurs, forming a disc-like layer of cells on the surface of a large, undivided yolk.

Holoblastic or total division occurs in all but the two most primitive mammals, the ornithorhynchus and echidna, in which there is a large polar yolk mass which does not divide completely into cells. The discovery of the latter fact affords a key to the apparently anomalous condition of the higher vertebrates, in which the embryo in its early stages of development resembles very closely that of reptiles and birds; and the fetal membranes show strict correspondence in form and function to those of the latter. The method of development and the form of fetal appendages peculiar to reptiles and birds is consequent upon the large mass of nutritive yolk contained in their eggs. The fact that the ova of higher mammals, while containing little or no yolk, yet in their development follow along the lines of yolk-containing eggs, is explained by the hypothesis that they have descended from oviparous ancestors whose eggs were rich in yolk.

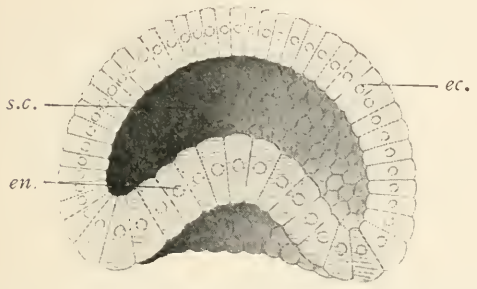


FIG. 59.—FORMATION OF GASTRULA, AMPHIOXUS. The entoderm, *en.*, has begun to invaginate, making the segmentation cavity, *s.c.*, smaller; *e.c.*, ectoderm.—(*After Hatschek.*)

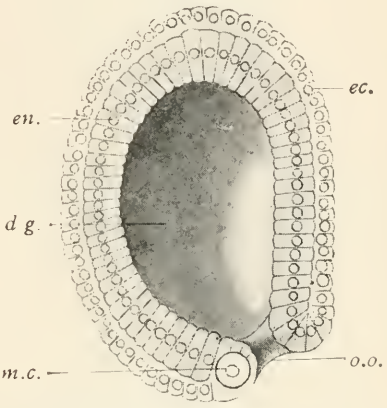


FIG. 60.—FORMATION OF GASTRULA IN AMPHIOXUS. The segmentation cavity has almost disappeared between the ectoderm, *ec.*, and the invaginated entoderm, *en.*, which lines the digestive cavity, *d.g.* or enteron. The opening of the latter is the original oral opening or blastopore, *o.o.* A single mesodermic cell, *m.c.*, at the left at the union of the ectoderm and entoderm.—(*After Hatschek.*)

According to this hypothesis, Monotremes and Marsupials are the connecting links between birds and mammals. In the evolution of viviparous mammals the membranes which were formerly of service in development within egg capsules and in the presence of nutritive yolk now become adapted for intra-uterine development where nourishment is received direct from the maternal organism. In some of the forms observed, the cells of the morula are not uniform in appearance, larger clear cells being massed at one pole, smaller dark cells at the other. The clearer cells grow and divide more rapidly, finally forming a complete envelope except at one point (as recorded by van Beneden) (Fig. 57), surrounding the smaller cells. As the morula passes by the action of the ciliated epithelium through the Fallopian tubes a liquid is formed between the two kinds of cells which increases in amount until there is produced a much enlarged, hollow sphere of flattened cells, within which and attached to one point is a group of smaller elements (Fig. 57). The former cells compose the subzonal layer, later, sometimes known as Rauber's layer; the latter are known as the inner cell mass and

eventually give rise to the major part of the ectoderm and the entire entoderm.

Formation of Germ-layers.—By reason of the control of conditions, which

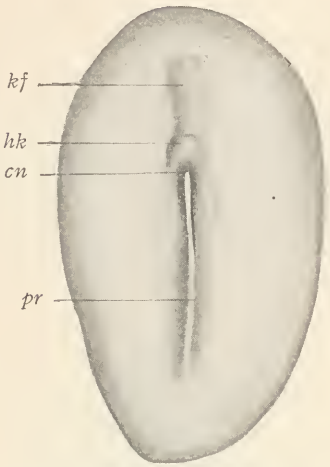


FIG. 61.—GERM-DISC OF AN EMBRYO RABBIT.—(After E. van Beneden.) *pr*, Primitive streak; *kf*, head process; *hk*, Hensen's node; *cn*, canalis neurentericus. —(*Hertwig-Mark.*)

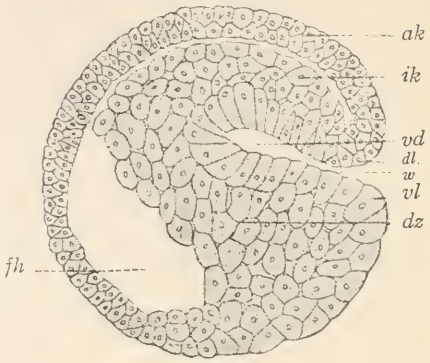


FIG. 62.—LONGITUDINAL (SAGITTAL) SECTION THROUGH AN EGG OF TRITON AT THE BEGINNING OF GASTRULATION. *ak*, Outer germ-layer; *ik*, inner germ-layer; *fh*, cleavage-cavity; *vd*, cœlenteron; *w*, blastopore; *dz*, yolk-cells; *dl* and *vl*, dorsal and ventral lips of the blastopore.—(*Hertwig-Mark.*)

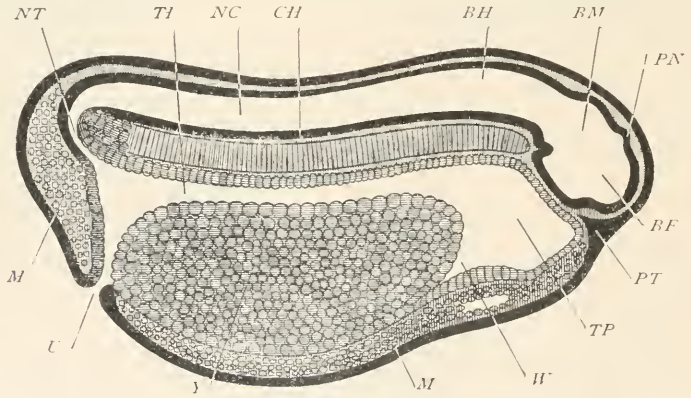


FIG. 63.—SAGITTAL SECTION OF FROG EMBRYO SHOWING THE THREE LAYERS. The blastopore now becomes the proctodeal opening and the neurenteric canal joining enteron with neural canal.—(*After Götte.*)

BF, Fore-brain; *BH*, hind-brain; *BM*, mid-brain; *CH*, notochord; *M*, mesoblast; *NC*, cavity of neural tube; *NT*, neurenteric canal; *PN*, pineal body; *PT*, point where future mouth arises; *TI*, intestinal region of mesenteron; *TP*, pharyngeal region of mesenteron; *U*, proctodeal aperture; *W*, liver; *Y*, yolk-cells.

is possible in that animal, the formation of germ-layers has been more fully and frequently studied in the chick than in any other species. The following changes, however, have been taken from the embryology of the rabbit, which is tolerably well understood, because this mammal naturally has more resem-

blance to man. The concentrated mass of cells above described at the pole of the ovum flattens out into a disc called the *blastoderm*, which is seen to

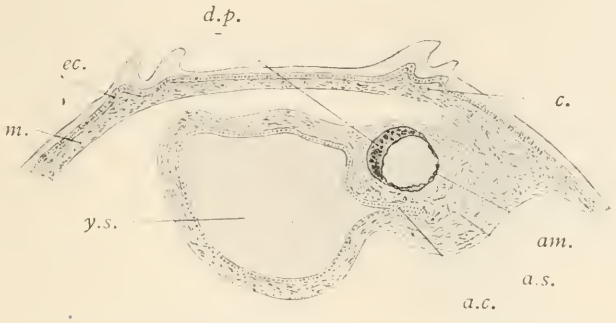


FIG. 64.—SECTION THROUGH EARLY HUMAN OVUM. × 24. *d.p.*, Embryonic disc; *ec.*, ectoderm; *m.*, mesoderm; *y.s.*, yolk-sac; *c.*, chorion; *am.*, amnion; *a.s.*, allantoic stalk; *a.c.*, allantoic canal.—(*After Graf Spee.*)

consist of two kinds of elements (Fig. 58, *c*), with two layers next to the outer sphere of flattened cells; and more or less continuous with it, which together are regarded as the *ectoderm*. The cells which complete the sphere are called, from their discoverer, Rauber's layer, and in the rabbit they disappear (see Membranes).

There are also cells lying next to the cavity which form the *entoderm*. This two-layered germ, though arising in a much modified manner, is properly comparable with the two-layered or gastrula stage of the amphioxus (Fig. 60), and the cavity is also called the *segmentation cavity*.* The blastoderm of the rabbit, as seen from above, soon takes the form of a shield, in the mid-line of which is seen the primitive streak (Fig. 61). In section this is found to be a thickened cord of cells in which ectoderm and entoderm fuse, and from the junction of which a third layer, called the *mesoderm*, extends out on either side. At the anterior limit of the primitive streak is located Hensen's knot; here the three primary germ layers are in intimate union; from this point grows forward the so-called head process from which the future body arises. The primitive streak in higher vertebrates is an elongated representative of the blastopore of the amphibia (Fig. 62), which in its turn repre-

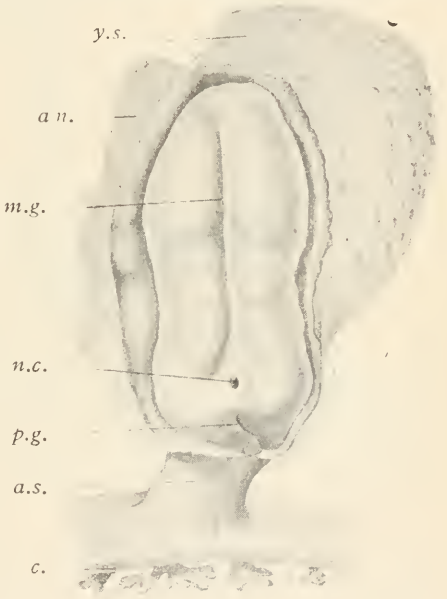


FIG. 65.—DORSAL VIEW OF A HUMAN EMBRYO. 1.54 mm. long. ×30. The amnion, *am.*, is nearly all removed. The yolk-sac, *y.s.*, shows blood islands. The elongated embryo shows a medullary groove, *m.g.*, the neurenteric canal, *n.c.*, and the primitive streak. The abdominal stalk, *a.s.*, connects it to the chorion, *c.*, with its branched villi. *p.g.*, Primitive groove. From a wax reconstruction.—(*After Graf Spee.*)

* Some investigators, notably O. Hertwig, dissent from this interpretation. Hertwig considers a stage like that of *d*, Fig. 57, as a single-layered blastula, and believes that here, as in other vertebrates, a two-layered gastrula arises by invagination or ingression of cells.

sents a modified gastrula mouth of the still earlier forms (Fig. 60). The blastopore of amphibia becomes covered by an unequal growth of cells, its last trace being in the neurenteric canal which connects the primitive enteron with the caudal end of the neural canal (Fig. 63). A neurenteric canal with the same essential relations is found in higher vertebrates at the cephalic end of the primitive streak. Finally blastopore, primitive streak, and neurenteric canal disappear, leaving no trace, but they are of profound interest, since they form a

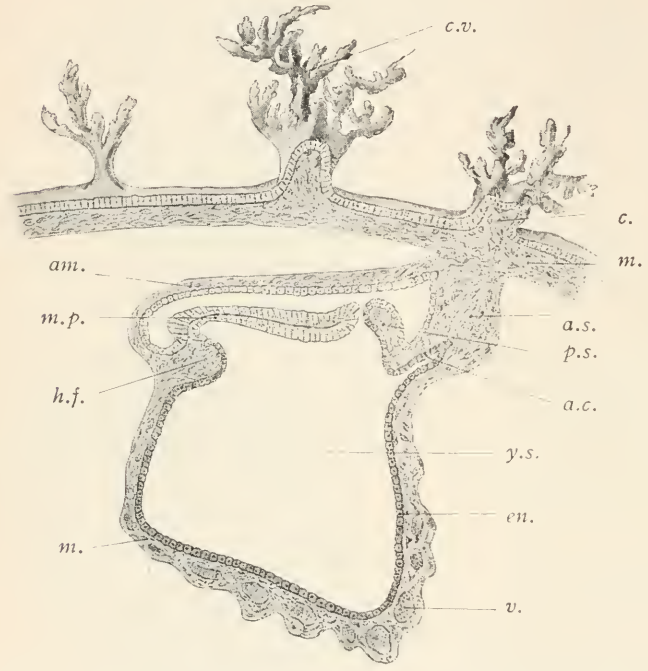


FIG. 66.—SAGITTAL SECTION OF FIG. 65. Showing in addition the allantoic process, the complete amnion, *am.*, with a slight extension toward the chorion, *c*, and the thickening of the mesoderm, *m.*, where the heart will develop. *m.p.*, Medullary plate; *h.f.*, heart fold; *c.v.*, chorionic villi; *a.s.*, allantois stalk; *p.s.*, primitive streak; *a.c.*, allantoic canal; *y.s.*, yolk sac; *en.*, entoderm; *v.*, vessels; *p.s.*, primitive streak.

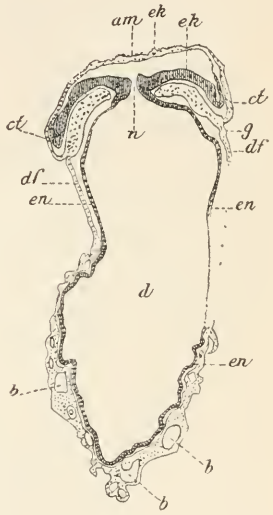


FIG. 67.—CROSS-SECTION OF FIG. 65. Shows the ectoderm forming the medullary folds and groove and at the right thinning to form the amnion. *am.*, Amnion; *ek.*, ectoderm; *ct.*, amniotic mesoderm; *g.*, meeting point of somatopleure and splanchnopleure; *df.*, mesoderm of yolk sac; *b*, *b*, *b*, blood-vessels; *en.*, entoderm; *n*, blastopore; *d*, cavity of yolk-sac. — (*After Graf Spee.*)

common landmark in early development throughout the vertebrate series, marking the point from which the mesoderm takes its origin. The neurenteric canal is seen in a very early human ovum described by Graf Spee (Fig. 65). According to Mall, its last remnant is distinct until adult structures are sufficiently developed to determine its relative location, it being at the level of the first rib. This one fact shows that the structures derived from the head and neck are the earliest to be laid down, the whole of the trunk and limbs being of later formation.

Formation of Primitive Organs.—The early embryology of organs has also been much more completely studied in the lower animals, though the differences that have been observed between the latter and man do not appear to be so radical in the organs as in the original layers. If the rabbit be taken as the

type, after the three layers—ectoderm, entoderm, and mesoderm—are differentiated, the ectoderm at some little distance in front of the primitive streak by a process of unequal growth becomes folded in, and in a similar way at the caudal end, while at either side folds are also formed, until by this means the embryo is outlined and somewhat raised above the general level of the embryonic shield. At the same time other folds affecting the ectoderm appear at either side of the axis and gradually extend caudally. These are the medullary folds, between which lies the medullary groove. The folds arise above the general level (Figs. 65, 66, and 67), and as they grow upward, fold over toward each other until they unite to form a tube. This is the *neural tube*, and is at first in connection with the ectoderm of the general surface of the body, which is now called the epidermis. The first closure of the tube is in the neck region, the closure extending both forward and back As the closure proceeds the tube is separated from the epidermis (Figs. 68 and 69). At either side, just at the junction of the part of the ectoderm which

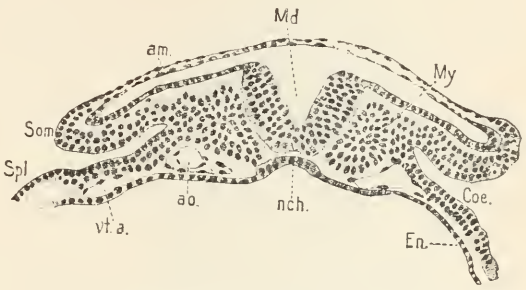


FIG. 68.—TRANSVERSE SECTION OF A MOLE EMBRYO. (HEAPE'S STAGE H.) *am.*, Amnion; *Md.*, medullary grove; *My.*, primitive segment; *Cœ.*, cœlom; *En.*, entoderm; *nch.*, notochord; *ao.*, aorta; *vt.a.*, vitelline artery; *Som.*, somatic mesoderm; *Spl.*, splanchnic mesoderm.—(*After W. Heape.*)

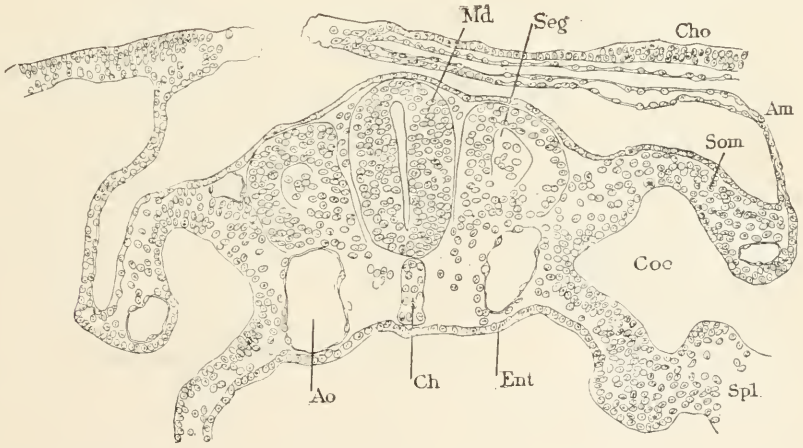


FIG. 69.—CROSS-SECTION THROUGH THE RUMP OF A RABBIT EMBRYO OF EIGHT DAYS AND THREE HOURS. The medullary or neural tube, *Md.*, is closed and completely separated from the epidermis, which is continuous with the epithelial layer of the amnion and chorion. At this level amnion and chorion have not separated and the folds forming them have not yet quite united. The notochord (*Ch*) is separated from the entoderm (*Ent*). The primitive segments (*Seg*) are hollow. The body-cavity, *Coe.*, is continuous with the extraembryonic cavity. There are still two aortæ, *Ao.*; *Cho.*, chorion; *Am.*, amnion; *Som.*, somatopleure; *Spl.*, splanchnopleure.—(*After Minot.*)

is to form skin with that which is to form the neural tube, there is a thickening of ectoderm which, in the form of a cord, becomes free from its attachment to the former. These cords come to lie on both sides of the neural tube and

give rise to the nervous ganglia and to the sensory roots of the nerves, and also finally to the sympathetic system. Before the closure of the tube is complete two pockets arise from it on the two sides near the cephalic end. These

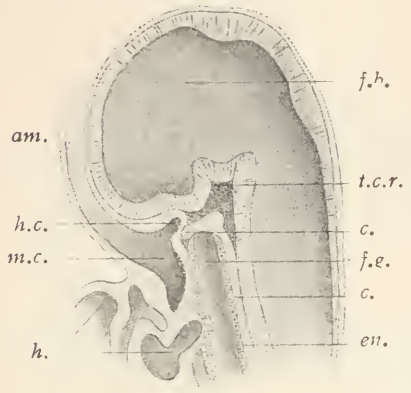


FIG. 70.—SAGITTAL SECTION OF A RABBIT WITH 8 TO 12 MYOTOMES. Shows the neural tube hollow and beveled to form the fore-brain, *f.b.;* the chorda, *c.*, bent and touching the hypophysis, *h.c.;* the blind end of the entoderm, *en.*, coming in contact with the ectoderm to form the oral plate; the continuation of the ectoderm to form the amnion, *am.;* the heart, *h.*, prominent and just below the mouth-cavity, *m.c.* *t.c.r.*, Trabeculæ cranii of Rathke; *f.g.*, foregut.—(*After Keibel.*)

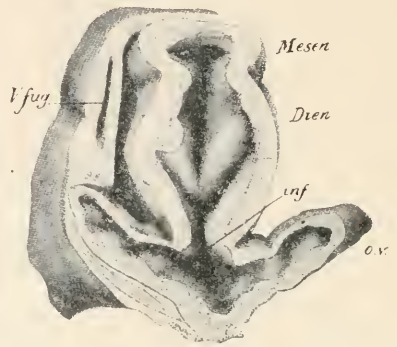


FIG. 71.—SECTION OF A MODEL OF A THREE WEEKS' HUMAN EMBRYO, SHOWING THE OPTIC VESICLES AS OUTPOCKETINGS FROM THE BRAIN.—(*Susanna Phelps Gage.*) *V.fug*, Jugular vein; *inf*, infundibulum; *Dien*, diencephalon; *Mesen*, mesencephalon; *o.v.*, optic vesicle; the notch at the tip is the beginning of the optic cup.

are the first indications of the eyes. As the tube closes the pockets extend farther and farther outward, becoming partly constricted off from the tube (Fig. 71). The outer surface of the pocket becomes pushed inward against the inner surface until a double-walled cup (Fig. 72) is formed, which ultimately becomes the many-layered retina, connected with the brain by the stalk which elongates and in which are developed the fibers of the optic nerve. The optic cup gives rise to few other parts of the eye, but the larger portion of them is produced from the mesoderm, which pushes in and around these fundamental parts (Fig. 72). At the same time that the optic cup is forming the ectoderm which covers it is producing an ingrowing pocket, which by a similar process is constricted and finally wholly separated from the ectoderm to form the lens of the eye, which fits into the opening of the optic cup (Fig. 72). The ectoderm also gives rise to the internal ear, which is completely constricted off, and to the external ear and the nasal epithelium, which form deep pockets but are never separated from

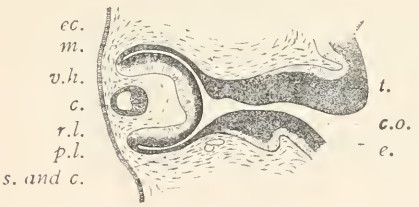


FIG. 72.—SECTION THROUGH THE DEVELOPING EYE OF A HUMAN EMBRYO (10.2 MM. LONG). Shows the open stalk connected with the mid-brain; the double-walled optic cup; the vesicle of the lens cut off from the ectoderm, *ec.;* and mesoderm growing in to form the cornea, *c*, vitreous humor (*v.h.*), etc. *m.*, Mesoderm; *r.l.*, retinal layer; *p.l.*, pigment layer; *s.* and *c.*, sclera and chorioidea; *t.*, thalamencephalon; *c.o.*, conus opticus; *e.*, ependyma.—(*After Kollmann.*)

the exterior. At the same time that the neural tube is forming, the entoderm along the middle line and just below the neural tube is by evagination and subsequent constriction forming a much smaller tube, which soon becomes solid and forms the notochord (Figs. 68, 69), the first trace of a body-axis. The notochord does not extend to the cephalic tip of the neural tube, but stops at the hypophysis (Fig. 70); that is, near the level of the sella turcica of the adult skull. The chorda and its cephalic end forms landmarks throughout the vertebrate series and from very early stages of development. In mammals it becomes insignificant, as it is enclosed in the vertebral column. The entoderm at first lines a simple, unconstricted yolk-sac (Figs. 64 and 66), but as the embryo grows out over the almost stationary sac the upper portion of the latter becomes separated by a constriction on all sides, more pronounced anteriorly and laterally, to give origin to a continuous tube blind at both its ceph-

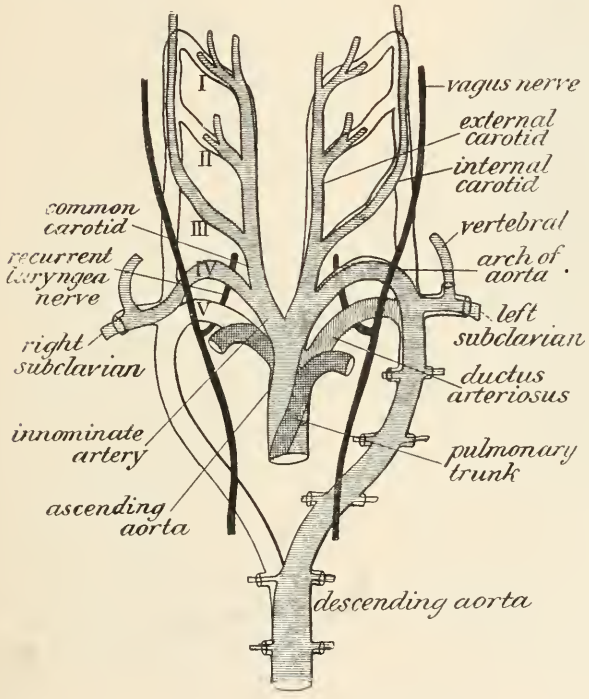


FIG. 73.—DIAGRAM SHOWING THE DESTINATION OF THE ARTERIAL ARCHES IN MAN AND MAMMALS.—(*Modified from Rathke.*)

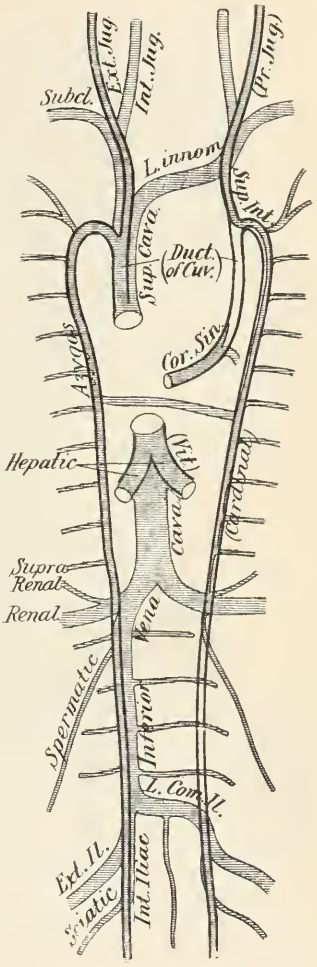


FIG. 74.—SCHEME OF THE DEVELOPMENT OF THE CHIEF VEINS OF THE BODY.—(*Quain.*)

alic (Fig. 70) and caudal ends, the alimentary canal. The union with the yolk-sac from which it was constricted becomes relatively smaller until there is a mere stalk, vitelline stalk (Figs. 65 and 75), at the extremity of which is the yolk vesicle. In mammals the yolk-sac grows for a time, and though it contains but a trace of nutritive yolk, it possesses a rich network of blood-vessels, known as the omphalomesenteric vessels. The sac loses all functional importance and soon begins to atrophy, but persists as a very small vesicle until birth, when it may be found

among the decidual tissues. Each of the blind tubes of the entoderm above mentioned comes in contact with an ingrowing pouch of ectoderm. The double layer so formed of ectoderm and entoderm (Fig. 70) breaks down, thus forming the openings from the alimentary canal to the exterior, the mouth (Fig. 75) and the anus. By a process of formation of pouches, modified sometimes into solid outgrowths or tubes, the entoderm of the alimentary canal gives rise to the lungs, liver (Fig. 75), pancreas, and the special glands of the enteron. The mesodermic sheet or layer arises at the primitive streak and first pushes forward at either side of the middle line but not crossing it. The portion lying next the notochord becomes segmented. Each of these segments at some stage is hollow and is called a somite (Fig. 69). That portion of the somite which lies next to the ectoderm and is known as the dermatome or cutis plate fuses with it to form a portion of the skin. The remaining part undergoes very extensive growth and modification to form the muscles of the body and limbs, and an important part of the mesenchyma from which the supporting and bony framework of the body is developed; that portion of the mesodermic somite from which the former arises is known as the myotome or muscle plate; that from which the latter structures arise the scelerotome. That portion of the mesoderm which does not take part in the formation of somites, and which lies at the sides of the latter, becomes early divided into two layers, one of which unites with the ectoderm to form the somatopleuric or parietal layer,—which gives rise to the body-wall, the amnion and chorion,—while the other, uniting with the entoderm, forms the splanchnopleuric or visceral layer, which gives rise to the alimentary canal and its derivatives (Figs. 67 and 68). It is the mesodermic portion of the latter which gives rise to the muscles and connective tissue of the alimentary canal.

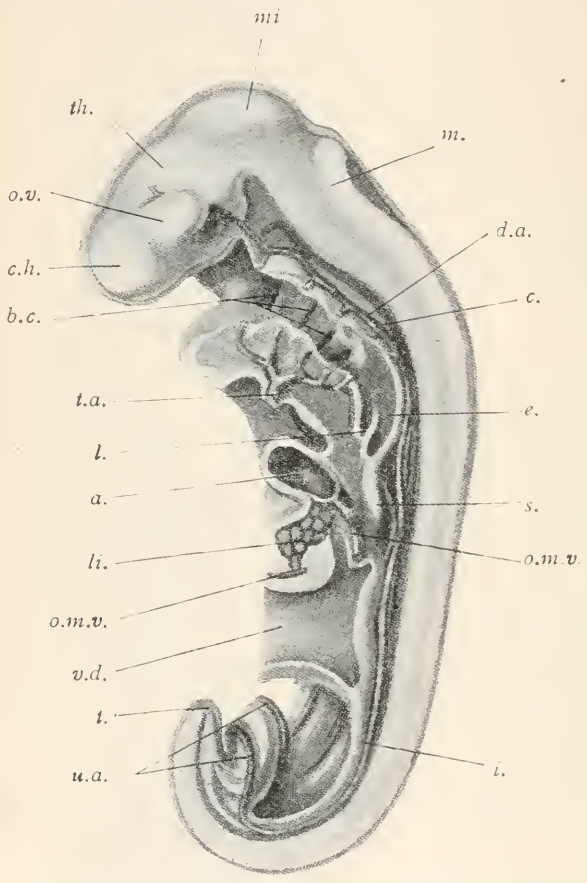


FIG. 75.—HUMAN EMBRYO AT THIRD WEEK. The left body-wall or side has been removed, so that the neural canal and gut are exposed. The left wall of the anterior end of the gut and the still very broad vitelline duct have also been removed. *th.*, Thalamencephalon; *o.v.*, optic vesicle; *c.h.*, cerebral hemisphere; *b.c.*, branchial clefts; *t.a.*, truncus arteriosus; *l.*, lung; *a.*, auricle; *li.*, liver; *o.m.v.*, omphalo-mesenteric vein; *v.d.*, vitelline duct; *t.*, tail; *u.a.*, umbilical artery; *mi.*, midbrain or mesencephalon; *m.*, medulla; *d.a.*, descending aorta; *c.*, chorda; *e.*, esophagus; *s.*, stomach; *i.*, intestine.—(*After His's model.*)

Fig. 76.
12th day
(nat. size).

Fig. 77.
21st day
(nat. size).

Fig. 78.
30th day
(nat. size).

Fig. 79.
34th day
(nat. size).

Fig. 80.
6½ week
(nat. size).

Fig. 81.—End of 2d month (62d day) (nat. size).

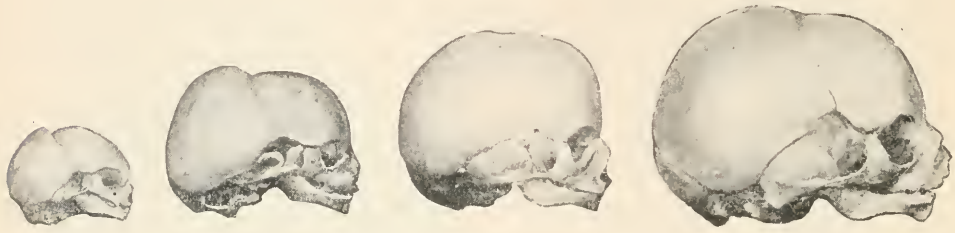
Fig. 82.—End of 3d month (nat. size).

Fig. 83.—End of 4th month (nat. size).

FIGS. 76 TO 83.—NATURAL SIZE AND DEVELOPMENT OF THE HUMAN EMBRYO IN THE FIRST FOUR MONTHS OF PREGNANCY.

(Figs. 76 to 81 are from His, and Figs. 82 and 83 are from Bumm's fresh fetuses.)

The space formed by the separation of these two layers of mesoderm is the body-cavity or cœlom. At first, in man, it seems to be separate from the extra-embryonic cœlom (Fig. 67), but soon becomes continuous with it, as in the rabbit (Fig. 69). Later this connection is lost by the growth of the body-walls to unite around the umbilical cord. The body-cavity proper is divided by the gradual growth of the diaphragm into abdominal and thoracic cavities. The thoracic cavity is further divided into the pericardial and the two pleural cavities. All the supporting and connective tissues, as bone, cartilage, and the muscles and



FIGS. 84, 85, 86, 87.—FETAL SKULLS OF THE FIRST THIRD OF PREGNANCY (TWO-THIRDS NATURAL SIZE).—(*Author's collection.*)

blood-vessels, take their origin from the mesoderm; but while the problems involved in a full consideration of the mesoderm and cœlom are fundamental in character, they are very complex and, moreover, have not been satisfactorily worked out in their finer details. (For the heart and vascular system, see sections on Nutrition and Circulation.)

The urogenital system is derived from a cord of tissue lying between the somites and the cœlom (Fig. 69). This early forms the Wolffian or pronephric duct, which gives rise to tubules forming the primitive excretory apparatus, the mesonephros or Wolffian body. In lower vertebrate forms a fetal kidney,

FIGS. 88, 89, 90.—FETAL SKULLS OF THE MIDDLE THIRD OF PREGNANCY (TWO-THIRDS NATURAL SIZE).—(*Author's collection.*)

called the pronephros, precedes the mesonephros. It exists in a very rudimentary condition in the human embryo. With the exception of its duct it entirely disappears to make way for the mesonephros. This structure projects far into the cœlom and its mesothelial covering cells which give rise to the Müllerian duct, and to the ova or zoöspores, the essential parts of the ovary or testis. The mesonephros disappears, gradually giving place to the definite kidney or metanephros, but its duct at the caudal end gives rise to the duct and tubules of the true kidney. In the male it produces the vas deferens.

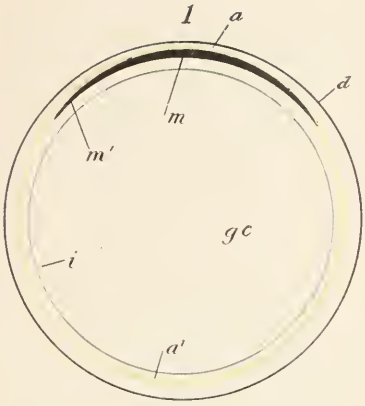
In the female the Müllerian ducts are transformed into the Fallopian tubes and caudally, by their union, into the uterus and vagina. The limbs arise as mere pads of indifferent mesodermic tissue covered by ectoderm. Into them gradually extend outgrowths of the myotomes producing muscles and carrying with them the vessels and nerves which have already joined them. A part of the mesoderm is condensed in rod-like forms. The connective-tissue cells are transformed into cartilage in those portions of the rods which are to form the bones. Where the joints are to be, the condensed connective tissue persists, forming amphi-arthrodial joints. The true synovial joints are developed later by a solution of the connective tissue between the ends of the cartilages. The hands are formed gradually from mere pads and the fingers are at first webbed.

In the main outlines human differentiation of organs is like that of the rabbit, as shown by the fact that the selected illustrations are mostly human; but in one important particular the distinctively human development differs from that of the rabbit, the body being outlined from outlying portions at a later

FIGS. 91 AND 92.—FETAL SKULLS OF THE NINTH AND TENTH MONTHS OF GESTATION (TWO-THIRDS NATURAL SIZE).—(*Author's collection.*)

stage relatively than in that animal. In this respect it more nearly resembles the mouse (see Membranes, page 61).

Tissues or Organs Derived from Each Germ-layer.—*Ectoderm:* (1) Ectodermic layer of chorion and amnion. (2) Epidermis with appendages (hair and nails); the epithelium of (*a*) all skin glands including the mammary; (*b*) the stomodeal portion of the mouth, including the salivary glands and the enamel of the teeth; (*c*) the nasal passages, upper part of the pharynx, and the hypophysis; (*d*) the proctodeal portion of the alimentary canal; (*e*) the crystalline lens and the external ear. (3) The whole of the nervous system, brain, spinal cord, nerves, ganglia, and epithelial portions of the organs of sense (retina, internal ear, olfactory, taste and tactile organs). *Mesoderm:* (1) The urinary and genital organs, except the lining of the bladder and urethra. (2) The skeleton and all supporting connective tissue. (3) All muscles, both striated and unstriated. (4) (*a*) The epithelium of the vascular and lymphatic systems and of serous cavities derived from the cœlom or arising in joints; (*b*) blood and lymph. *Entoderm:* The epithelium of the alimentary canal (exclusive of the stomodeum and proctodeum) with that of its derivatives, Eustachian tube, thymus, thyroid, lungs, liver, pancreas, bladder, urethra, urogenital sinus, and all the small glands and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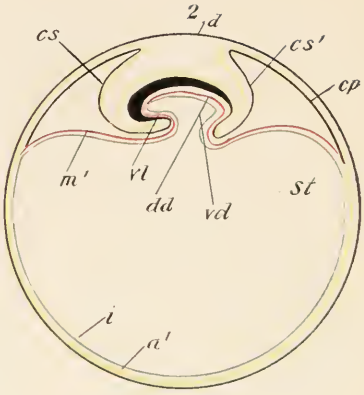
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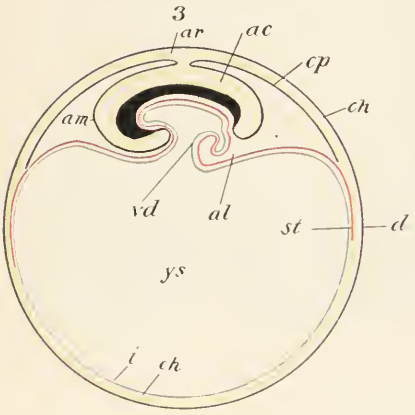
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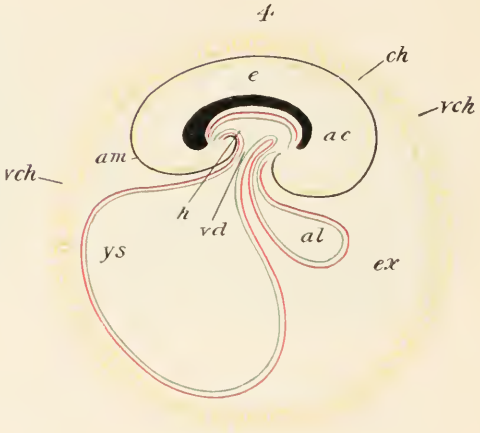
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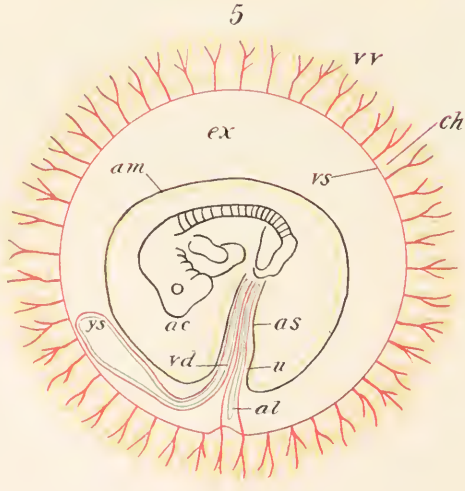
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tubules, together with the rudimentary allantois and the yolk-sac belonging to the membranes.

Origin of Membranes.—The membranes are the extra-embryonic portions of the ovum which serve to aid in its protection and nutrition. Because of the ease and frequency of the study, the most familiar type of membrane formation has come to be that of birds. In these animals the folds of united mesoderm and ectoderm or the somatopleure (see above), which have been tucked in all around to outline the embryo, rise up outside the embryonic region until, like the medullary folds, they unite over the back of the embryo to form a closed sac. Synchronous with the upward growth a still more peripheral portion of the splanchnopleure continues around the ventral portion until a union takes place. This results in the formation of a continuous sac enclosing both embryo and yolk-sac. The portion of the membranous sac dorsal to the embryo is now composed of two layers connected in the middle line. The line of junction breaks down, and there results an inner closed sac, the amnion, covering in the dorsal part of the embryo and formed by an extension of its body-wall; and an outer closed sac, the chorion, which encloses not only the amnion with the embryo, but the yolk which depends from the ventral side of the latter. It also includes the white of the egg and lies next the shell. From the caudal end of the entoderm grows out a sac, the allantois, covered with the splanchnopleuric layer of mesoderm and carrying with it blood-vessels from the heart. The allantois expands until it comes in contact with the chorion, where it brings its blood-vessels close to the exterior, thus serving as an organ of respiration. In some mammals, as the rabbit, horse, pig, and cow, a modification of the above method of membrane formation occurs which is in the nature of an abbreviation of the process. As stated above, in such forms the ovum consists at the end of segmentation of an outer Rauber's layer, with a nodule of cells at one pole (Fig. 57). The cells at the pole multiply and spread out in the form

FIG. 93.—FIVE SCHEMATIC FIGURES ILLUSTRATING THE FETAL MEMBRANES; ALL THESE, WITH THE EXCEPTION OF THE LAST EMBRYO, ARE REPRESENTED IN LONGITUDINAL SECTION.—(*After Koelliker.*)

1, Blastodermic vesicle with zona pellucida, segmentation cavity, germinal area, and site of the embryo. 2, Blastodermic vesicle with developing yolk-sac and amnion. 3, Blastodermic vesicle with closing amnion and protrusion (or budding) of the allantois. 4, Blastodermic vesicle with chorionic villi, larger allantois, and embryo with oral and anal orifices. 5, Blastodermic vesicle showing vascular allantois in contact with the chorion and penetrating the villi of the same; an umbilical cord is indicated; the yolk-sac is atrophic and the amniotic cavity is increasing in size. The ectoblast is represented in yellow, the visceral mesoblast and the vascular layer of the allantois and yolk-sac are red, the entoblast green. The zona pellucida in Figs. 1 to 3 is represented in black, as are also: Fig. 1, the entire middle germinal layer; Figs. 2, 3, and 4, the parietal mesoblast of the amnion; Figs. 2 to 5, the mesoblast in the neighborhood of the embryo, with the exception of the splanchnopleure and heart.

a, Place at the origin of the embryo showing thickening of the wall of the germinal vesicle; *ac*, amniotic cavity; *al*, allantois; *am*, amnion; *ar*, commissure of the amnion; *as*, amniotic fold of the umbilical cord; *vs*, vascular layer of the allantois; *vv*, vascularized chorionic villi; *d*, zona pellucida; *dd*, site of the gut lined with entoblast; this site originates from a portion of the inner layer of the blastodermic vesicle (later the epithelium of the yolk-sac); *vd*, vitelline duct; *e*, embryo; *h*, region of the heart; *gc*, segmentation cavity which later becomes *Ys*, the cavity of yolk-sac; *cs*, head-fold of the amnion; *m*, thickening of the middle layer of the blastodermic vesicle which is a part of the site of the embryo *m'*, at first extending no further than the germinal area; *ex*, original space between amnion and chorion (exocœlom); *ch*, chorion, as yet without villi (serous covering); *cs'*, tail-fold of the amnion; *st*, region of the sinus terminalis; *u*, urachus (allantoic stalk); *vl*, anterior body-wall in the region of the heart.

In figures 2 and 3 the amniotic cavity has, for the sake of clearness, been drawn too large. The cavity of the heart has everywhere been represented too small and many details, more particularly the body of the embryo, have, with the exception of figure 5, simply been shown schematically.

of a plate which gives rise to the three layers, the ectoderm becoming continuous with Rauber's layer. The entoderm grows around inside the ectodermal layer and forms the hollow yolk-sac. The splanchnopleure never completely invests the yolk, as it does in the chick; the somatopleure forms the amnion outside the embryo and a chorion which separates from the amnion (Fig. 69); the principal modification consisting in the fact that as the mesoderm does not extend to the ventral limit, the chorion, composed of ectoderm and mesoderm,

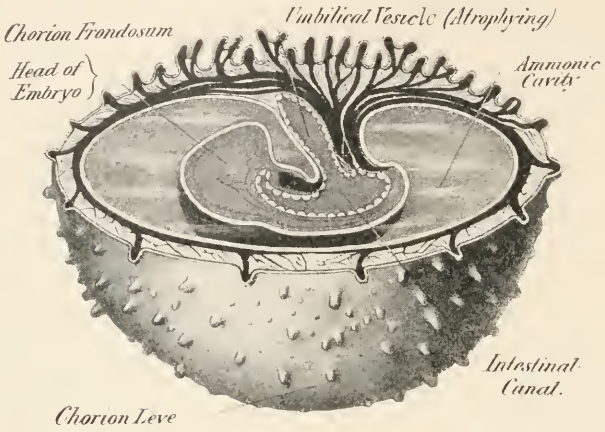

FIG. 94.—SCHEMATIC REPRESENTATION OF EARLY EMBRYONIC STRUCTURES.

is not completed on the ventral side. This interval is completed by the simple layer of ectoderm forming Rauber's layer. The modification is still further emphasized by the atrophy and disappearance of the cells of this layer. The facts just stated have given rise to many ill-founded theories with regard to human development; thus, Rauber's layer was supposed to have no relation to the true ectoderm, and as the entoderm seemed to come to the surface, it was supposed that there was a so-called "inversion of the germ-layers."

FIG. 95.—HUMAN OVUM TWELFTH TO THIRTEENTH DAY.—(*Reichert.*)

Another modification of the membrane-formation which has been used to explain the condition in man is well illustrated in the mouse and some other rodents. The heap of cells at the pole first differentiates off a few entodermal cells which multiply and form a layer. A cavity then appears in the ectodermic portion of the mass of cells which enlarges so greatly as to form a sac nearly covered by the ectodermic layer, the whole extending far into the interior of

the outer or Rauber's layer of the ovum. The embryo is formed at the deepest portion of this invagination. The amnion is produced by the growing together in an hour-glass-like formation of the invagination over the back of the embryo; the remaining portion next the original implantation of the heap of cells becoming the chorion and finally a part of the placenta. Here, too, the remaining portion of the ectoderm in Rauber's layer does not apparently become a part of the chorion. Contrary to the condition in the chick, rabbit, and many other mammals, the allantois of the mouse does not form a large pouch of entoderm, but is a small tubular invagination of the yolk-sac. It is, however, covered by mesoderm, which continues as a sheet over the chorion and carries the blood-vessels of the embryo to the placenta, where the blood is aerated.

In Peters's embryo, the youngest human specimen studied, it is seen that the conditions are not as in the chick, with early formation of embryo and subsequent differentiation of membranes; nor as in the rabbit, nor even quite as in the mouse. The membranes in Peters's embryo have been developed precociously (Fig. 51). The chorion is a completely closed sac with a mesodermic lining, such as occurs quite late in the chick. There is no sign of the disintegration of the outer ectodermic layer, as in the Rauber's layer of the rabbit, but later stages (according to Mall) indicate that it becomes transformed into the syncytial layer of the chorion (*q. v.*). The amnion is also a closed sac with the undifferentiated embryo, a simple thickened plate of cells, lying in its deepest portion, thus having a strong resemblance to the early condition in the mouse. The yolk-sac is also closed and is larger than the amnion, but is not constricted with any indication of an alimentary tract, as would be the case in the chick at a similar stage of development with reference to the mesoderm. The latter has, indeed, attained a remarkable development. It has entirely invested the yolk-sac forming the splanchnopleure, while the somatopleure is represented by the amnion and the chorion completely invested by the mesoderm before there is an indication of the formation of somites. Whether the amniotic sac becomes hollowed out of a solid mass of cells, as seems to be the case in the mouse, or whether there is only a division of the amnion from the chorion, such as occurs in the rabbit (as surmised by His and Nagel), although taking place relatively earlier, cannot be determined without further investigation. In Graf Spee's embryo (Figs. 65 and 66), and in an ape examined by Selenka, an appearance is found which points to the latter conclusion; since the amnion in these specimens has a diverticulum pointing toward the chorion, as though just constricted off therefrom. The important point in this connection is that the amniotic sac never separates completely from the chorion as with the rabbit, but remains connected with it by a broad band of mesoderm. In the next later stages of human embryos it is found that a small diverticulum of the yolk-sac extends into this mass of mesoderm, which has become relatively smaller, forming the stalk which with further development becomes the umbilical cord. Although a true allantois—in the sense that it occurs in the chick and many mammals—is not present, the mesodermic layer of that organ may be said to exist; since the blood-vessels, when they arise, pass by way of this allantoic rudiment through the abdominal stalk to the chorion. To sum up, but that this earliest human ovum, before an embryo has even been outlined, has membranes of a stage of development corresponding to a much later stage in the chick, a closed chorion, a closed amnion, a closed yolk-sac. The essential difference is that there is no free allantois containing an extensive entodermic cavity, and that the mesoderm connects the embryo with the chorion from the earliest stages and not secondarily.

The Membranes at Term.—At term the fetus is surrounded by three mem-

branes, two of which are of fetal and one of maternal origin. Their order, from within outward, is: amnion, chorion of fetal origin, and decidua reflexa and vera of maternal origin.

The Amnion.—As seen above, the amnion is the innermost of the fetal membranes. At first it encloses only the dorsal part of the embryo, but with growth and closure of the body-wall around the umbilicus, it completely invests the embryo except that the cord passes through it. It is continuous with the fetal epidermis at the umbilicus (Figs. 65, 66, 67, 93, and 94). It consists of two layers, one of flattened cells derived from the ectoderm and continuous with the epidermis, the other of connective-tissue cells and fibers, mesoblastic in origin. The enclosed space constitutes the true amniotic cavity or sac, and its chief function is the secretion of liquor amnii. At first the amnion, as compared with the embryo, is quite large. Then the embryo grows more rapidly and the amnion closely invests it; and finally at the second month a more rapid growth of the amnion takes place, which ultimately results in a close relationship between it and the chorion. As long as a cavity exists between amnion and chorion it is sometimes called the false amniotic cavity and is filled with a liquid somewhat similar to the amniotic fluid. At birth the bag of waters consists of the amnion and part of the chorion. Sometimes this is not ruptured until after the head is born.

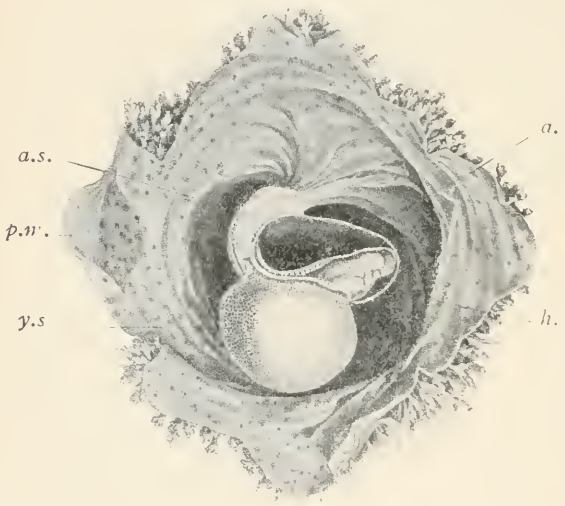

FIG. 96.—RUPTURED HUMAN OVUM FIFTEENTH TO EIGHTEENTH DAY. Amnion has been opened. *a.s.*, Allantois stalk; *p.m.*, parietal mesoblast; *y.s.*, yolk-sac; *a.*, amnion; *h.*, heart.—(*Coste.*)

Liquor Amnii.—The amniotic fluid contained in the amniotic sac is somewhat variable in quantity, the average being about a liter, or quart. Of this, nearly one-half is formed during the last three lunar months. At times this fluid is very scanty, so that it interferes with the growth of the fetus, and causes its premature expulsion. There is on record a case in which, in the absence of a normal supply of liquid, ulcers were formed on the knees and ankles of a fetus, due possibly to friction. Many other deformities have been found to be correlated with the same condition. When its amount is excessive, the condition is called hydramnios, in which many quarts of fluid may be present. The amniotic fluid is alkaline in reaction. Its greatest bulk —nearly 99 per cent.—consists of water, in which are found albumin; creatin; epithelial cells from the fetal skin, bladder, and kidneys; sebaceous material; urea and several inorganic salts (phosphates, chlorides); as well as many other constituents. Its specific gravity varies between 1.0005 and 1.0082. It is generally opaque, white in color, although this may change from the presence of unusual ingredients, meconium giving it a dark brown tinge, while a macerated fetus colors it red. It has a heavy and characteristic odor. Keim has found that the freezing-point of this fluid is higher at term than that of the maternal

or fetal blood-serum. This indicates an intrinsic tendency to absorption. Its origin is a moot question. The theory that it consists chiefly of fetal urine is disproved by chemical analysis, only a small part arising from this source. The fetal tissues contribute a small portion by exudation. The greater part is of maternal origin and the result of transudation through the placenta. The investigations in regard to the two sources of the amniotic fluid have been as varied as they are interesting. As to the excretion of urine by the fetus, there seems to be undeniable evidence, more than three pints of this excretion having been found in the fetal bladder. After the communication between the bladder and the exterior of the body is completed through the agency of the urethra, there is from time to time a passage of the renal secretion from the fetus into the amniotic fluid. At just what stage of fetal development this occurs has not yet been decided. This prenatal urine is very poor in coloring-matters, as may be seen from the specimens collected soon after birth. Another theory

FIG. 97.—ISOLATED TERMINAL BRANCH OF VILLUS FROM THE CHORION OF AN EMBRYO OF TWELVE WEEKS.—(*Minot.*)

FIG. 98.—CHORIONIC VILLI AT FIVE MONTHS —(*Minot.*)

supposes that the fetal skin is the source of this fluid, and there has, indeed, been noted in several cases a connection between affections of the fetal skin —in one instance extensive nevi—and hydramnios. The view that much of the liquor amnii has a maternal source is substantiated by the results of numerous experiments. Tuntz, after the injection of sulphindigotate into the veins of pregnant rabbits, recognized the reagent in the liquor amnii by its blue coloring-matter, while there was no trace of it in the fetal kidneys. Experiments with other substances—*e. g.*, iodin, salicylic acid, and potassium ferrocyanid—have been made. Chloroform administered to the mother in labor has been demonstrated later in the umbilical circulation, so that it probably exerts an anesthetic influence on the fetus. However, the endeavor to introduce such substances as fat, vermilion, and india ink into the fetal circulation by administering them to the mother has had doubtful success, positive results being undoubtedly dependent on injury to the blood-vessels.

There has been much discussion as to the passage of formed elements, such as pathogenic bacteria, from the mother to the fetus; and various opinions are held on the subject. Certain substances taken by the mother are found later in the liquor amnii, even when the fetus is dead—showing that the latter took no part in the process. Also cases in which the product of conception is early destroyed exhibit an amount of amniotic fluid corresponding to the age of the ovum, and not to the development of the embryo.

Functions.—The functions of the liquor amnii are varied, being chiefly, however, protection for mother and child. It saves the uterus from the injurious effects of fetal movements. It distends that organ, and thus allows a certain freedom of movement to the fetus, and by the prevention of adhesions between the amnion and child it lessens the chance of development of monstrosities as well as intrauterine amputations and other abnormalities, and prevents any harmful pressure by the uterine walls. The amniotic fluid has a specific gravity near enough to that of the fetus to lessen greatly the muscular efforts in its movements. It protects the fetus from external violence and maintains for it an equable temperature. It receives and dilutes the fetal secretions and, according to some authorities, serves as a source of nourishment to the fetus. This last suggestion has little foundation, although the presence of lanugo and epithelial cells in the meconium shows that the amniotic fluid has been swallowed. It is quite probable, however, that it supplies to the fetal tissues a large proportion of the water which they possess before birth, in order, according to Preyer, that they may be able to absorb from the blood of the umbilical vein the albumin and salts which it contains. Finally, the hydraulic action of the amniotic fluid is most valuable in labor. It forms a veritable water-wedge, and serves by its downward pressure to dilate the circular muscle bands of the os uteri; and after being released from the amniotic sac it acts as a lubricant to the birth canal.

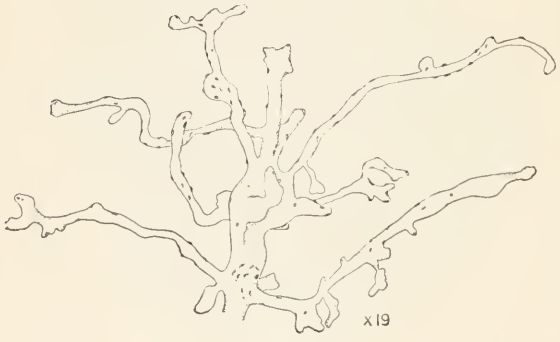

FIG. 99.—CHORIONIC VILLI AT FULL TERM.—(*Minot.*)

The Allantois.—The allantois in many mammals is a diverticulum of the caudal part of the alimentary canal, which carries with it the splanchnic layer of the mesoderm until contact is made with the chorion, thus forming a large sac containing fluid. But in man the entodermic diverticulum is a mere rudiment (Fig. 66) which can be traced along the umbilical cord for some distance but does not form a free sac. A mesodermic layer, however, perfectly analogous to that of other mammals, does connect the caudal end of the embryo with the chorion and serves to carry the blood-vessels from the embryo to the chorionic villi. This mesodermic layer, as seen above, is precociously formed. As in other mammals, the proximal portion of the allantoic rudiment forms the urinary bladder and the urachus which becomes one of the ligaments of the latter.

The Chorion.—There is probably no organ in the human fetus which has been the subject of such false conceptions as the chorion. It is defined by Minot as follows: "The whole of that portion of the extra-embryonic somatopleure which is not concerned in the formation of the amnion." As shown above,

the young human ovum already has a chorion with a mesodermic lining (Figs. 64 and 51). It is covered by villi, solid outgrowths of the epithelial layer, which show slight cavities at their bases into which the mesoderm protrudes. The villi extend into the uterine mucous membrane in such a way as to indicate that epithelium, glands, and walls of blood-vessels in their path have been disintegrated and not merely pushed aside; that is, they protrude freely into the maternal blood. In the somewhat later stage shown in Reichert's ovum (Fig. 95) the villi are grouped in a band, leaving the two flattened poles of the ovum bare. Still later the villi become hollow with two distinct layers of epithelium, and soon are penetrated by blood-vessels which have entered the mesoderm of the chorion. The simple club-shaped villi of the early ovum soon begin to degenerate on the side next to the decidua reflexa until in this part the chorion is smooth, *chorion lævе* (Figs. 53 and 104). On the smaller area next the decidua serotina, the villi become greatly enlarged and complexly branched, the blood-

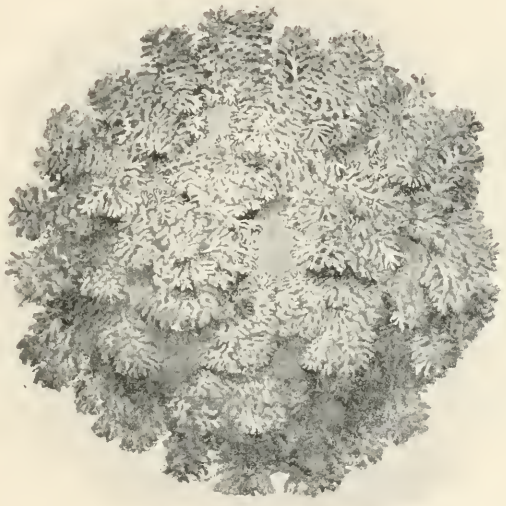

FIG. 100.—UNRUPTURED HUMAN OVUM OF ABOUT THIRD WEEK, SHOWING CHORION. × 2½.—(*Author's case.*)

vessels of the embryo following the ramification. This part of the chorion is called the *chorion frondosum*, and becomes the fetal portion of the placenta (Figs. 53 and 100).

The outer layer of the epithelium of the villi undergoes a peculiar modification. The cells, rapidly developing, do not entirely separate, but form a syncytium * with numerous nuclei. As seen from the first, this has a destructive effect on the uterine mucosa and blood-vessels (Fig. 64). On account of the theoretical objections to the idea of contact of fetal epithelium and maternal blood with no intervening maternal structures, the syncytium has been considered by many as an altered maternal structure covering the blood sinuses. All the evidence now accumulating seems to point in the direction above stated,

* Syncytium: (1) A single cell having many nuclei; (2) a structure composed of epithelial cells, forming the outermost fetal layer of the placenta and lying between the decidua and chorionic villi over the layer of Langhans.

that it is a fetal structure; and the chorionic villi, although bathed in maternal blood, separate the latter from the embryonic blood. The villi assume different characteristics at different stages of development. At the stage of formation of the placenta at the third month they are irregular, short, and thickset (Fig. 97). Later they are more regular and the angle formed by the junction of their branches with the parent stem is more obtuse (Fig. 98). At the close of pregnancy their arrangement is more regular, while the branches are less densely crowded and far more slender (Fig. 99). Knowledge of the appearance of the villi is most important, since the existence of pregnancy is positively confirmed by their microscopic detection in suspicious discharges from the vagina. The embedding of the villi in the decidua is never very intimate, and throughout their course of development they can be extricated with very little difficulty.

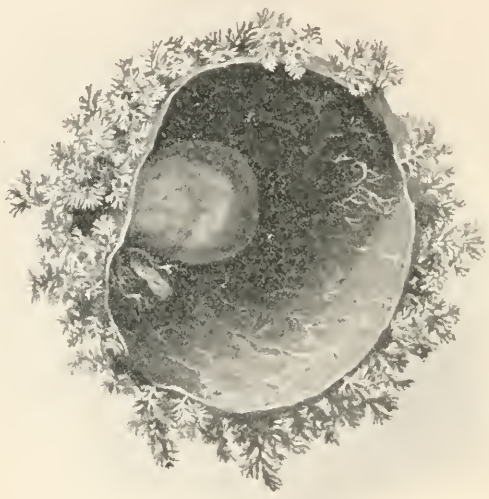

FIG. 101.—OVUM OF FIG. 100 CUT OPEN, SHOWING EMBRYO AND AMNION. × 2½.—(*Author's case.*)

A large number of the villi do not penetrate the decidua to any depth; those which are intimately joined to it are called the anchoring or fastening villi.

The Placenta.—The placenta is the essential nutritive and respiratory organ of the fetus. It results from the union of the chorion frondosum, *q. v.* (placenta fœtalis), and the decidua serotina (placenta maternalis). *Formation:* In addition to the growth of the chorionic villi, *q. v.*, there are extensive changes in the placental region of the decidua, which also proliferates and forms septa; these, growing down between the chorionic villi, sometimes reach the surface of the chorion. It is only at the margins of the placenta that the decidual septa are well marked. Interesting and important formations in the placenta are the intervillous spaces. The decidua vera is abundantly supplied with a network of blood-vessels which, as we have already seen, are entered by the growing villi of the chorion. With continued growth these open capillaries become the intervillous spaces, which are really large sinuses or lacunæ of maternal blood, the endothelial cells of which have disappeared. As a result of this change the branched chorionic villi extend freely into an almost continuous

sinus of maternal blood which is bridged by villi (anchoring villi) the tips of which are embedded in the decidua. The little curling arteries, so called, which are derived from the maternal blood-vessels, run along the decidual septa and empty into the sinuses near the chorion. The maternal veins start from the bases of the septa, and thus the circulation is maintained through the sinuses. *Structure:* The mature placenta is a flat, round or oval, sponge-like body which measures from 6 to 8 inches (15 to 20 cm.) in diameter and 0.8 to 1.2 inches (2 to 3 cm.) in thickness at the central point, while the margin is about 0.2 inch (0.5 cm.) in thickness. Its weight is about a pound (500 grams). After expulsion the uterine or maternal surface is dark red and granular, invested by a grayish, transparent membrane consisting of the superficial layer of the cells of the decidua serotina, and is marked by numerous ridges and lines which divide it into irregular lobes called cotyledons. These number from sixteen to twenty. On this surface of the separated placenta are tags of tissue corresponding to the decidual layer. The placenta, when detached from its bed, shows the line of demarcation in the spongy layer (*q. v.*) of the decidua. The fetal surface, smooth and shining, is covered by the amnion, and the umbilical cord is attached to its center. The bulk of the organ is spongy in character and consists of the tufts of chorionic villi and the intervillous spaces which are divided into cotyledons, above mentioned, by septa of connective tissue. After the separation of the placenta from its maternal site tags of decidua and chorion hang from the latter. Around the peripheral margin of the placenta is sometimes seen a circular vein, the "circular vein of the placenta." *Site:* * The placental site, as has already been described, is at the junction of the chorion frondosum and decidua serotina, which generally takes place near one of the tubal orifices, although the organ may be found attached to any point in the cavity of the uterus. As a rule, it faces the ventral surface of the fetus.

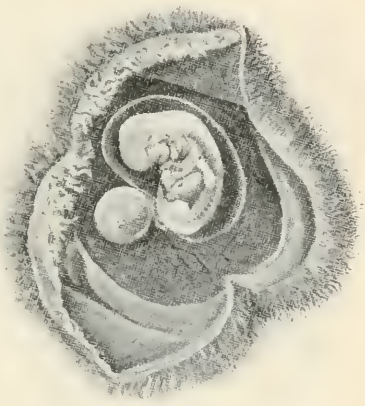

FIG. 102.—HUMAN OVUM AND EMBRYO AT FOUR WEEKS. × 2 and reduced.—(*Schultze.*)

The Umbilical Cord.—The umbilical cord is a means of communication between the fetal and maternal organisms. It is also called the funis, funicle, or navel string. *Origin and development:* In the human ovum the mesodermic connection of the amnion with the chorion, including the rudimentary allantois, is called the abdominal stalk (Figs. 64 and 65). With the growth of the body-wall and the extension of the amnion this stalk, together with the stalk of the umbilical vesicle, and the blood-vessels which unite the embryo with the chorion, become invested by a continuation of the somatopleure, the whole forming the umbilical cord (Fig. 96). The umbilical vesicle itself is never included within this cord (Fig. 96), but extends freely beyond it, and by the fourth week becomes inconspicuous. *Structure and vessels:* The epithelium of the cord consists not of a single layer but of several layers of stratified epithelium, continuous at the proximal end with the epi-

* For the exact location of the placenta, see Diagnosis of Pregnancy, and Cæsarean Section.

FIG. 103.—COMPLETE OVUM AND DECIDUA VERA OF ABOUT THE SIXTH WEEK. Shows smooth and rough surfaces of decidua vera and chorion. Photographed under water. × 2.—(*Author's case.*)

dermis and at the distal end with the amniotic epithelium covering the placenta. The cord is not covered by the amnion throughout its entire

FIG. 104.—OVUM OF FIG. 101 OPENED; SHOWS CHORION REMOVED EXCEPT AT SITE OF RUDIMENTARY PLACENTA ABOVE AND TO THE RIGHT; AMNION, LIQUOR AMNII, AND EMBRYO WITH RUDIMENTARY UMBILICAL CORD. × 1½.—(*Author's case.*)

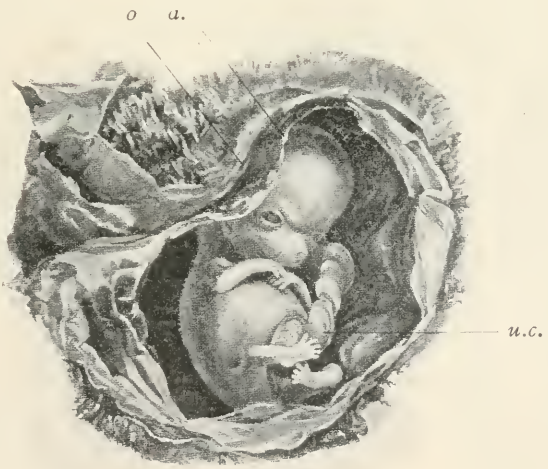

FIG. 105.—RUPTURED HUMAN OVUM AT EIGHT WEEKS. × 2. *c*, Chorion; *a*, amnion; *u.c.*, umbilical cord.—(*Schultze.*)

extent, for this latter structure is always separate from the cord proper. A gelatinous substance, Wharton's jelly, protects the cord vessels perfectly from

FIG. 106.—AMNION, LIQUOR AMNII, EMBRYO, AND UMBILICAL CORD, ABOUT THE TENTH WEEK. × 1½.—(*Author's case.*)

FIG. 107.—AMNIOTIC CAVITY INFLATED, SHOWING MATERNAL SURFACES OF PLACENTA AND AMNION AND UMBILICAL CORD EMERGING FROM CAVITY OF AMNION. FULL TERM.—(*From a photograph of a fresh specimen.*)

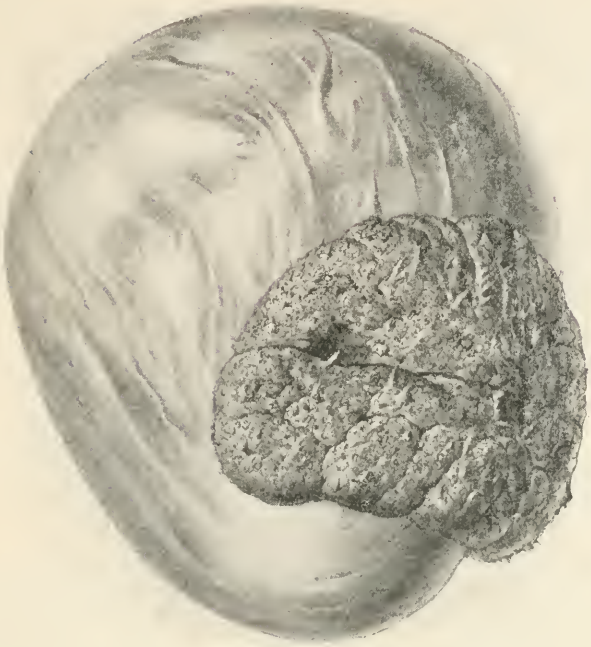

FIG. 108.—PLACENTA AND UNRUPTURED MEMBRANES AT THE THIRTY-EIGHTH WEEK. (One-third natural size.)—(*Author's collection.*)

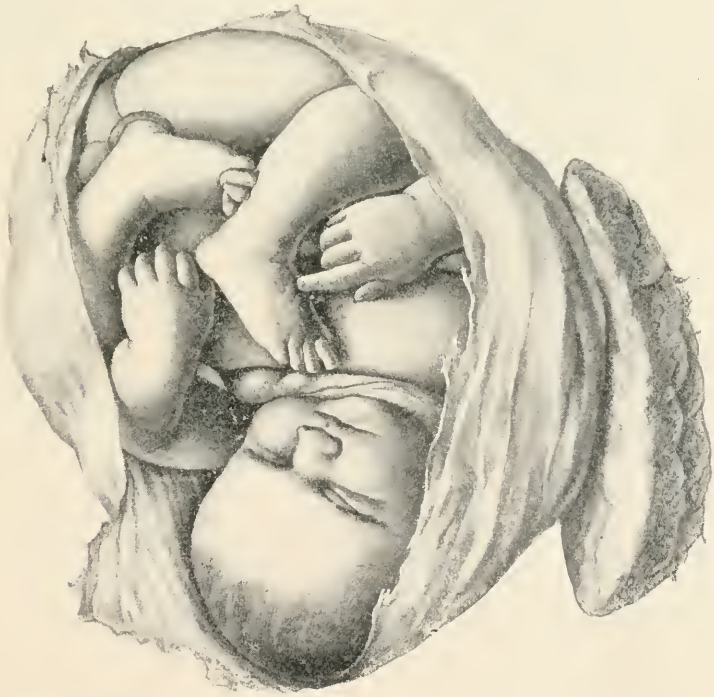

FIG. 109.—MEMBRANES OF FIG. 108, CUT OPEN TO SHOW FETUS. Specimen hardened in formaldehyde before rupturing. (One-third natural size.)—(*Author's collection.*)

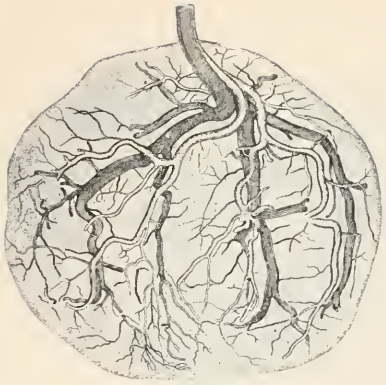

FIG. 110.—FETAL SURFACE OF PLACENTA AT TERM.—(*Minot.*)

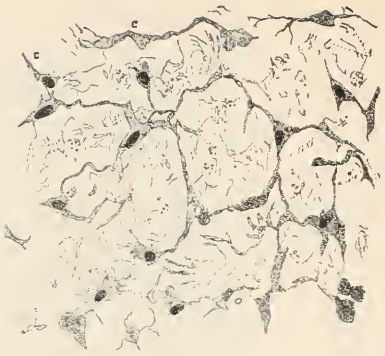

FIG. 112.—CONNECTIVE TISSUE OF THE UMBILICAL CORD OF A HUMAN EMBRYO OF ABOUT THREE MONTHS. × 511 diameters and reduced. Stained with alum cochineal and eosin.—(*Minot.*)

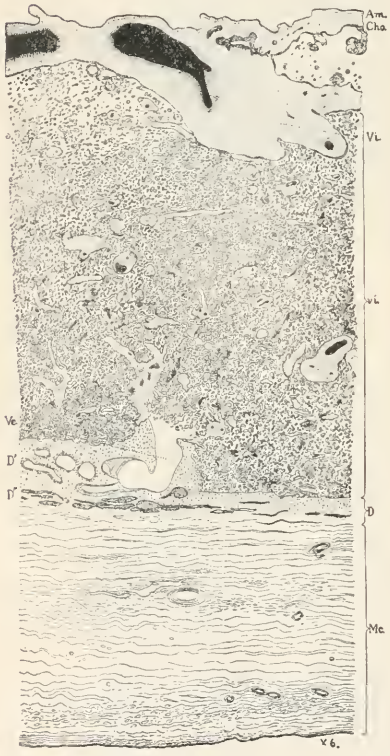

FIG. 111.—SECTION OF HUMAN PLACENTA OF SEVEN MONTHS IN SITU. *Am.*, Amnion; *Cho.*, chorion; *Vi*, trunk of villus; *vi*, sections of villi in the substance of the placenta; *D*, decidua basalis; *Mc.*, muscularis; *D'*, compact layer of decidua; *Ve.*, uterine artery opening into the placenta. The fetal blood-vessels are drawn black; the maternal blood-spaces are left white; the chorionic tissue is stippled except the canalized fibrin, which is shaded by lines; the remnants of the gland-cavities in *D''* are stippled black.—(*Minot.*)

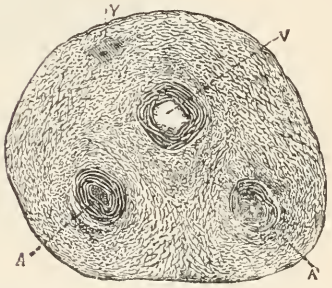

FIG. 113.—CROSS-SECTION OF UMBILICAL CORD AT TERM. × about 12 diameters. *Y*, Remnant of the allantois; *V*, umbilical cord; *A*, *A*, umbilical arteries.—(*Minot.*)

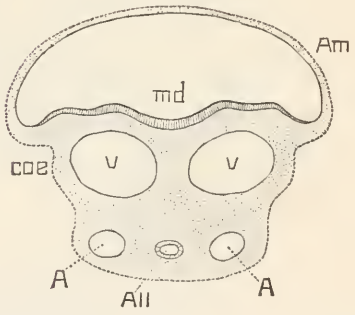

FIG. 114.—TRANSVERSE SECTION THROUGH THE UMBILICAL STALK OF AN EMBRYO OF 2.10 MM.—*Am.*, Amnion; *md.*, medullary groove; *V*,*V.*, umbilical veins; *A.A.*, umbilical arteries; *All.*, allantois; *coe*, cœlom. (*His.*)

harmful pressure. It is derived from the mesodermic layer of the abdominal stalk. The gelatin has an irregular distribution, being thicker in some parts, where it forms the so-called false knots in the cord. This peculiar substance consists in great part of embryonic connective tissue, and is abundantly supplied with branching cells, the protoplasmic processes of which freely anastomose. The vessels of the funis are originally two arteries and two veins. The two veins fuse early, leaving only one (Figs. 110 and 113), which comes to lie between the arteries, so that the funic pulse can be easily felt. The vessels are coiled from right to left, there being ten to twelve such turns. The spiral aspect thus given to the cord has been variously explained. One cause assigned is the fetal

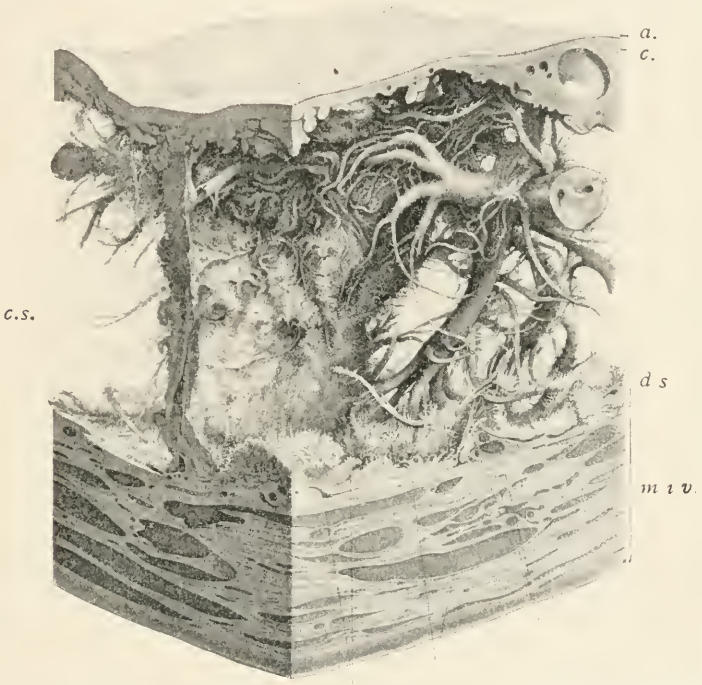

FIG. 115.—SECTION OF INJECTED FULL-TERM PLACENTA. *c.s.*, Cotyledon septum; *a.*, amnion; *c.*, chorion; *d.s.*, decidua serotina; *m.i.v.*, muscle with injected vessels.—(*Leopold.*)

movements; another, the fact that the growth of the blood-vessels in length is more rapid than that of the connective tissue. The walls of both arteries and vein are of about equal thickness. The calibre of the vein is in excess of that of the arteries; and while the vein has semilunar valves, the arteries have circular valves. The length of the cord averages about 22 inches (50 to 60 cm.), though when very long it may measure 64 inches (160 cm.), while the shortest on record is 4.8 inches (12 cm.). Its diameter is from $\frac{3}{8}$ to $\frac{5}{8}$ of an inch (1.1 to 1.5 cm.). The strength of the cord varies; its tensile power at term ranging from 5 to 12 pounds (2 to 5 kilograms). Its function is twofold: It carries nourishment from the mother to the fetus as well as waste matter from the fetus to the placenta.

Nutrition and Metabolism of the Ovum, Embryo, and Fetus.*

Ovum.—The primordial human ovum in the ovary derives the nourishment by which it grows from the general blood and lymph supply of the ovary, and in so doing lays up a small amount of nutriment in comparison with that of the germ-yolk or deutoplasm or food-yolk (Fig. 96). It is still an open question whether the follicle-cells surrounding the ovum contribute directly to its nourishment. As the ovum passes through the oviduct, as already stated, it increases in size by absorption of liquid, which separates the primitive chorion from the germ mass (Fig. 57). Later, and until it possesses vessels and circulation, it derives its nourishment from the intimate relations of the chorionic villi with the maternal blood (Fig. 49). The decidua vera, by reason of its increased cell-formation, indicates the presence of active metabolism favorable for the production of nutritive substances available for the growing embryo. There has been endless discussion concerning the intervillous spaces. One theory regards them as dilated uterine glands which secrete "uterine milk" for nourishing the ovum. It is now known that the glands become practically closed and that their ducts degenerate before the growing villi.

During the third week the vitelline or earliest embryonic circulation develops, beginning in the mesodermic layer of the yolk-sac in the form of blood islands (Figs. 65 and 66). In the mean time the original sparse food-yolk has increased in amount within the yolk-sac, and the blood islands unite to form vessels which again combine to form the omphalomesenteric or vitelline veins by which the contents of the umbilical vesicle are carried to the embryo proper for its nourishment. At the same time the heart and systemic vessels arise (Figs. 65 and 70) and blood passes through the vitelline veins into the sinus venosus. Then, mixing with blood returned by the systemic vessels from the body of the embryo, it passes into the single auricular segment or caudal end of the tubular heart The blood is conveyed from the anterior or arterial extremity of the heart through the truncus arteriosus to the aortic arches (Fig. 73); from the latter it flows into the two primitive aortæ. The smaller quantity is carried into vessels which nourish the embryo, while the greater portion reaches again the vascular area by the vitelline arteries. Thus a complete circulation in closed vessels is formed for the nourishment of the embryo.

True Chorion.—The development of this organ has already been described. The villi, hollow at first, are invaded, soon after their appearance, by mesoderm and then by blood-vessels derived from others which grow out along the abdominal stalk. With the development of these vessels the primitive chorionic circulation is established, which rapidly supersedes the vitelline. With the distinct localization of the placenta this becomes the placental circulation. After the earlier stages of development, all the returning placental blood passes through the liver on its way to the heart, but when the placental circulation becomes more extensive the extra work is assumed by the development of the ductus venosus, through which a considerable amount of blood passes directly into the inferior vena cava without traversing the liver (Figs. 100, 101, 102, and 103).

Functions of the Placenta.—The placental functions are varied, and it may be stated in general that it assumes the rôle of several other organs, the lung or gill, the alimentary tract, liver, and kidney. It aerates the fetal blood,

* The term ovum, as here used, indicates not only the unfertilized egg, but also the fertilized egg and the early stages of its development; it therefore includes not only the embryo but the membranes. The term fetus is used to designate somewhat loosely the later stages of the developing organism.

supplying it with oxygen so that it is the respiratory organ of the fetus. It absorbs nutriment from the maternal blood, thus playing the part of the mature alimentary tract. It has been shown, according to Bernard, to possess a glycogenic function analogous to that of the liver. It also serves the purpose of an excretory organ, eliminating not only the carbon dioxid but other abundant waste products of the fetal metabolism. Interesting work has been done, showing the peculiar selective power possessed by the epithelial cells of the chorionic villi. They eliminate the carbon dioxid of the fetus, and if the interchange of gases were reversed, the villi absorbing carbon dioxid from the maternal blood, this would prove fatal to the fetus.

Fetal Blood.—In the early months of gestation the fetal blood contains nucleated red blood-corpuscles, sharply distinguishable from those of the mother. At first these are few in number, but increase very rapidly; so that in well-preserved specimens the vessels are large, conspicuous objects and are crowded with corpuscles. At about the third month the majority of these cells have been replaced by non-nucleated corpuscles similar to those of the adult. The relative quantity of blood in the fetus and placenta undergoes considerable variation, the placenta at first having the larger amount; later the fetus and placenta contain about equal amounts, while still later the quantity in the fetus exceeds that in the placenta. The fetal arterial blood-pressure is about half that of the newly born child, while the venous pressure is much higher. The velocity of the blood in the umbilical arteries is far slower than in adult arteries of similar calibre. The fetus eliminates about the same volume of carbon dioxid as it absorbs of oxygen. This latter amount is about one-fourth that used by the maternal organism, and the amount of gas concerned in the placental system is about one-half that which is used in the lung during respiration In this way the slight metabolism of the fetus is explained; consequently when the communication with the mother is severed, the possibility of survival is longer, and is not followed by immediate suffocation, while it also accounts for the slight difference in temperature of mother and child.

Kidney Excretion.—The kidneys begin to assume functional form at the seventh week. At first their ducts communicate with the rudimentary allantois, but since the bladder is derived from this organ, the ureters finally empty into that viscus. In the course of development urine is excreted by the fetus from time to time, as can be proved by the presence of urea in the amniotic fluid. There is always a certain amount of albumin in the fetal urine. There is a specially important medico-legal point in connection with the appearance of the kidneys: it is the formation of dark yellow infarcts, which are invariably present even if the infant has breathed but for a very short time before death. Their causation is not known.

Bowel Excretion.—The bowels are normally inactive in intrauterine life, although in pathological conditions—*e. g.*, apoplexy, coiled cord, compressed cord, etc.—there may be a discharge of meconium. This should be a danger-signal when occurring in labor, unless there is a breech presentation.

The Fetal Circulation.—As stated in the section on nutrition, the first signs of the blood and blood-vessels in the embryo are the blood islands in the umbilical vesicle. The heart in reptiles, birds, and mammals, so far as has been sufficiently determined, has been found to develop as two independent tubes in the visceral layer of the splanchnopleure of the neck region. As the two visceral layers fold over the ventral side of the embryo and fuse, the double heart also fuses to form a single tubular heart. The separation into auricles and ventricles of a right and a left heart is due to the growth of valves and par-

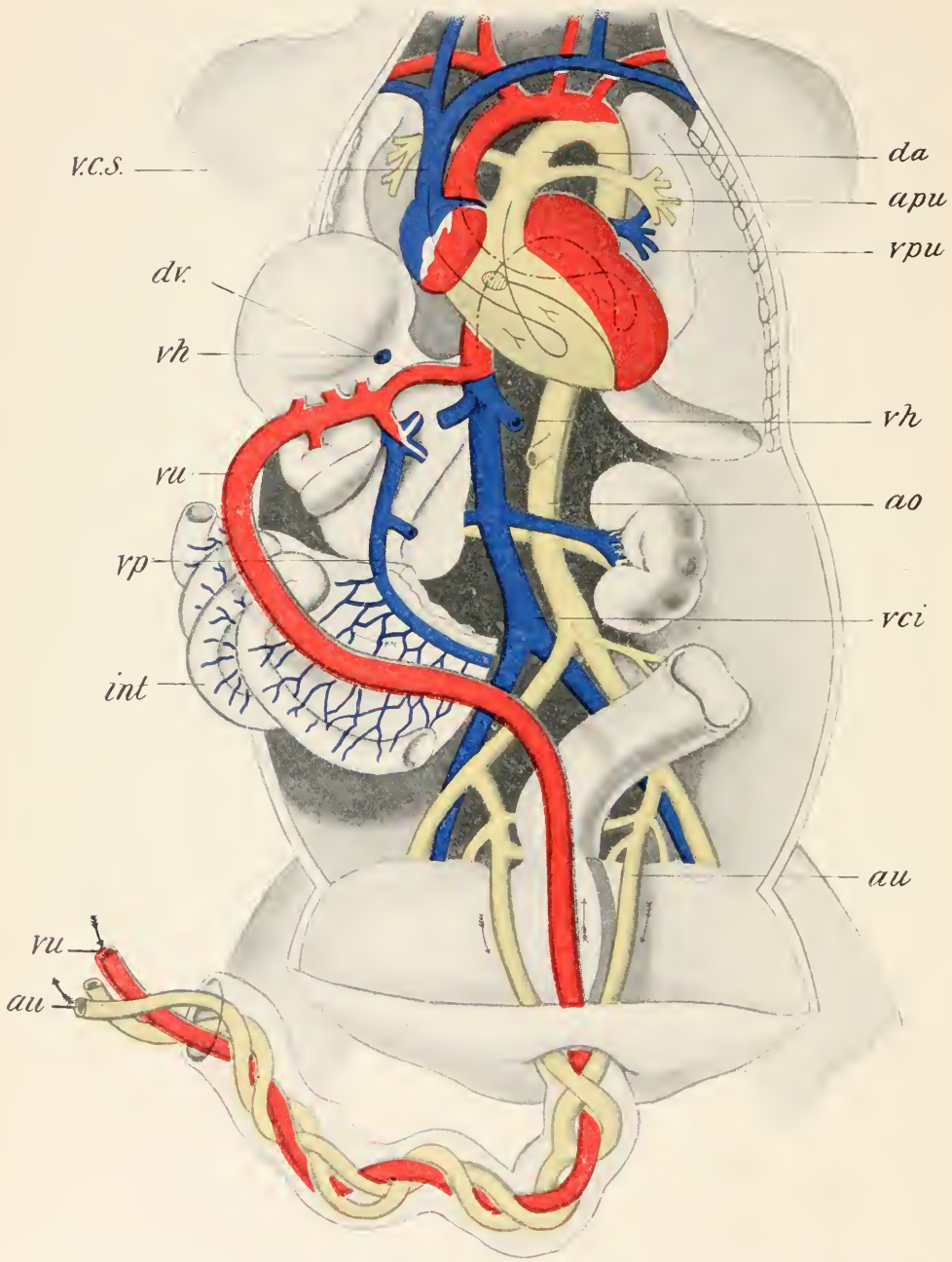

FIG. 116.—THE FETAL CIRCULATION. *ao*, Aorta; *a.pu*, pulmonary artery; *au*, umbilical artery; *da*, ductus arteriosus; *dv*, ductus venosus; *int*, intestine; *vci* and *vcs*, inferior and superior vena cava; *vh*, hepatic vein; *vp*, vena portæ; *v.pu*, pulmonary vein; *vu*, umbilical vein.—(*From Kollmann.*)

titions in this single tubular heart. From the cephalic end of the primitive tubular heart extend two primitive aortæ, and from the caudal or venous end extend the two vitelline veins. All of the subsequently developed arteries and veins are likewise in pairs except the posterior cava (inferior vena cava). The adult condition of the vascular system is attained by two processes: viz., suppression and fusion. The suppressions and fusions are shown in part in Figs. 73 and 74. Advancing from the primitive embryonic condition, the vessels of the allantois and placental circulation soon cause the development of a more complicated system, in which the heart and liver play important rôles. In the later months of pregnancy the blood, laden with nutriment for the developing fetus, collects from the ultimate venous rootlets in the chorionic villi and ultimately finds its way to the (1) *umbilical vein*. At first there are two umbilical veins, but soon the right fuses with the umbilical cord and only the left persists. This enters by way of the umbilical cord, passes first to the navel, and thence upward along the free suspensory ligament of the (2) *liver* to the under surface of this organ, where it subdivides into several branches. Two of these go to the left lobe and the others to the lobus quadratus and the lobus Spigelii. The vein again subdivides at the transverse fissure into two branches, the larger of which, joining with the portal vein, penetrates the right lobe. The smaller, as the (3) *ductus venosus*, or duct of Arantius, passes on across the inferior hepatic surface until it meets the (4) *left hepatic vein* just at that point where the latter vessel joins the (5) *inferior vena cava*. The blood which circulates through the liver undoubtedly undergoes certain changes in metabolism, and finally collects again in the hepatic vein, through which it flows to the ascending vena cava. Thus there are two avenues through which the blood, flowing through the umbilical vein, reaches the inferior vena cava; the greater part, together with the portal venous blood, circulating through the liver, previous to entering the vena cava by the hepatic vein. The remainder goes directly to the vena cava by the union of the ductus venosus and the left hepatic vein. The blood coming from the ductus venosus and hepatic veins mingles in the inferior vena cava with that from the lower extremities and the abdominal viscera. It flows into the (6) *right auricle*, and, directed by the (7) *Eustachian valve*, it courses through the (8) *foramen ovale* into the (9) *left auricle*. Here it joins a little blood that has come from the lungs by the pulmonary veins. It then flows from the left auricle to the (10) *left ventricle*, and thence into the (11) *aorta*, by which it is in great part taken to the (12) *upper extremities* and (13) *head*. A little passes down by the (14) *descending aorta*. The blood from the head and upper extremities is collected by the (15) *venous radicles* and finally reaches the branches of the (16) *superior vena cava*, known in earlier stages of development as the right duct of Cuvier. This is formed by the junction of a superior vein (the primitive jugular) and an inferior cardinal vein, the corresponding left duct disappearing in the process of development. The superior vena cava empties into the (17) *right auricle*, where it mingles with a small quantity from the inferior vena cava; it then passes over the Eustachian valve into the (18) *right ventricle*, and thence into the (19) *pulmonary artery*. Since the fetal lungs are solid and almost impervious, but a small portion of the blood from the pulmonary arteries passes to them and is then returned by the pulmonary veins to the left auricle. The greater quantity flows through the (20) *ductus arteriosus*, reaching by this channel the (21) *descending aorta* (see 14), where it joins the small part of the blood from the left ventricle which has also passed into this artery. It now descends to supply the (22) *abdominal and pelvic viscera* and the (23) *lower extremities*, although its greater part flows

through the (24) *hypogastric arteries* to the (25) *umbilical arteries* and the (26) *placenta.*

Peculiarities of the Fetal Circulation.—Several facts stand out with special clearness in this process of fetal circulation: (1) The duplex function of the placenta—respiration and nutrition. In this organ the venous or impure blood is oxygenated and surcharged with nutriment, and returns to nourish the fetus. (2) By far the greater part of the blood of the umbilical vein circulates through the fetal liver, which fact accounts for the very large size of that organ, especially in early fetal existence. (3) The right auricle is the meeting-place for a dual current, that from the inferior vena cava being guided by the Eustachian valve into the left auricle, while the blood coming from the upper extremities and the head descends from the right auricle into the right ventricle. In early stages the entrance of the ascending vena cava is almost directly into the left auricle, so that there is probably little or no mingling of the two streams, but later the two auricles are more definitely separated and a certain mixing of the two currents occurs. The blood from the placenta, together with that from the ascending cava, is carried through the left heart almost directly to the aortic arch, whence it proceeds by means of the large aortic branches which are given off near the heart to the head and upper extremities, thus accounting for the extremely well-developed condition of these parts; while the blood that has already circulated in the upper parts, being thereby deprived of most of its nutriment, is carried, together with a small part from the left ventricle, to the viscera and lower extremities; and this fact consequently accounts for the small size and poor state of development of the latter.

Characteristic Features.—The characteristic features of the fetal circulation are (1) the ductus venosus, (2) the ductus arteriosus, (3) the foramen ovale, (4) the hypogastric arteries, and (5) the umbilical vein. After birth circulation and respiration take place as in the adult, although the changes leading to the complete functional development of the systems and the atrophy of the fetal structures take a considerable period of time.

The Earliest Human Ovum.—The earliest ovum in an apparently normal condition is that described and figured by Peters in 1899 (Fig. 51). It was sectioned with a portion of the uterine wall in which it was partially embedded. The extreme limits of the ovum are about 0.12 × 0.06 × 0.06 inch (3 × 1.5 × 1.5 mm.), in the form of a flattened sphere. The outer surface or chorion is covered by villi, and it is found that it is a hollow sac, the cavity of which measures 0.064 × 0.032 × 0.036 inch (1.6 × 0.8 × 0.9 mm.). Within the sac of the chorion and attached to one side is a cellular mass about 0.008 inch (0.2 mm.) in diameter and containing two cavities. The cavity lying nearer the chorion is the amnion; the other cavity is the yolk or umbilical sac. The amnion is formed as a closed sac of a single layer of cells which are elongated on the side away from the chorion; *i. e.*, in that part where from later stages it is known the embryo will be formed. The yolk-sac is lined by entodermal cells, and between it and the above-mentioned thickened ectodermal cells is a layer of mesoderm which not only lies between ectoderm and entoderm, but completely envelops the yolk-sac and the amniotic sac and forms a connection between these and the chorion and then forms a complete lining for the chorion. Thus it is seen that in this early human embryo, in which the body is represented by a flat or concave disc of ectoderm, a layer of mesoderm, and a sac of entoderm, the relative rate of development of parts has been quite different from that described above for the rabbit. This difference becomes more apparent when the membranes are discussed. But it is seen that there is essential unity

in the fact that the three germ-layers exist. Just how they arise in man must await solution until still younger human embryos are as carefully preserved and studied as was Peters's specimen.

Characteristics of the Ovum, Embryo, and Fetus in the Several Lunar Months of Gestation.—These are of value to enable us to determine the exact period of gestation, the cause of the premature interruption of pregnancy, the clew to many congenital deformities and intrauterine diseases and accidents, and tests of maturity.

Embryos of the First Month.—The size of the ovum described by Peters is 0.12 × 0.06 × 0.06 inch (3 × 1.5 × 1.5 mm.); and of the embryonic area about 0.0076 inch (0.19 mm.). The chorion is hollow with a mesodermic lining and solid epithelial villi. The amniotic sac is formed and the embryonic area is merely a thickened portion of this sac. The yolk-sac is larger than that of the amnion. The embryonic mass is attached to the chorion by a wide mesodermic connection which completely separates the latter from the amniotic epithelium. Spee's specimen (Fig. 64) measures 0.28 × 0.22 inch (7 × 5.5 mm.), and the embryo 0.0148 inch (0.37 mm.). The mesodermic connection of embryonic mass with the chorion is narrower and blood islands have appeared on the yolk-sac. In Eternod's specimen the chorion measures 0.432 × 0.328 × 0.24 inch (10.8 × 8.2 × 6 mm.) and the embryo 0.052 inch (1.3 mm.). The embryonic area is somewhat elongated and shows a neural groove and neurenteric canal. The heart is at the extreme cephalic end of the embryonic area. Vascular connections are established between yolk and embryo and also with the chorion. In Spee's specimen (Fig. 65), measuring 0.072 × 0.06 inch (1.8 × 1.5 mm.) with embryo 0.0616 inch (1.54 mm.), the chorionic villi are already branched with mesoderm penetrating them. The allantoic rudiment extends into the abdominal stalk, but heart and blood-vessels do not seem to be so far advanced as in Eternod's smaller specimen. At the end of the third week (Figs. 100 and 101) the ovum measures about 1 × 0.8 inch (25 × 20 mm.) and the embryo 0.16 to 0.2 inch (4 to 5 mm.). The villi are distinctly branched. The embryo is well outlined; head, trunk, tail, and limbs are recognizable. The neural tube is completely closed and differentiation into brain and eye vesicles has begun. The internal ear is a closed vesicle. The nasal epithelium is a thickened disc. The mouth connects with the pharynx, in which are four branchial clefts. The alimentary canal is a straight tube except for the wide connection with the yolk-sac and its appendages; thyroid, thymus, lungs, and liver are recognizable. The heart tube has assumed the characteristic S-shaped twist, and though divided into auricular and ventricular portions, is not separated into right and left halves. The mesonephros (primitive kidney) is prominent. The somites are numerous and distinct. The limbs form bud-like projections. In other words, during the third week the majority of the organs take on recognizable features (Figs. 75, 76, 77, and 78).

End of First Month or Fourth Week.—*Characteristics of ovum:* Waldeyer's classical description of an ovum four weeks old gives its size as that of a pigeon's egg; in length $\frac{3}{4}$ inch by $\frac{2}{3}$ inch broad (20 × 16 mm.). (Mall gives 1.12 × 0.8 inch—28 × 20 mm.—for an embryo of twenty-seven days.) Its weight was 34.5 grains (2.3 grams). The chorion is a flattened vesicle containing fluid and is made up of two walls. The inner wall is smooth while the outer one bears the branching villi. It is not firmly embedded in the uterine tissue and its separation can easily take place. The yolk-sac is larger than the cephalic extremity of the embryo and its stalk is enclosed in the umbilical cord. A clear space

separates the chorion from the amnion, which remains close to the embryo. The embryo and chorion are connected by blood-vessels which do not penetrate the villi (Fig. 102).

Characteristics of the embryo: At this period the human embryo can be distinguished from that of any other mammal only with great care. It is much curved, head and tail being close together, and is $\frac{1}{3}$ inch long (7 to 8 mm.); or, taking the vertex-coccygeal length, $\frac{4}{5}$ inch (20 mm.). Weight, 20 grains (1.30 grams). The cerebral vessels are present, and the brain and spinal cord are enclosed. The eye and ear vesicles can both be distinguished and the nasal epithelium forms a slight pit. Only three branchial clefts are clearly seen. The tongue is a mere rudiment and the mouth is perforate. The liver shows marked growth and the kidneys appear about this time, with the beginnings of the pancreas. The heart is very prominent and its division into four cavities has begun. It has probably assumed its function by the third week. It is covered by the pericardium. The rudimentary extremities are still bud-like (Figs. 78 and 79).

End of Second Month or Eighth Week.—*Characteristics of ovum:* The ovum at the end of the second month is as large as a hen's egg. It is about 2 inches (5 cm.) long by $1\frac{3}{5}$ inches (4 cm.) wide. Its weight is from 330 to 375 grains (22 to 25 grams). About the middle of this month there is a more luxuriant growth of the villi at one part on the chorion marking the origin of the placenta. Instead of obtaining nourishment from the umbilical vesicle, the fetus now depends wholly on the maternal blood for its food. The umbilical vesicle is much smaller proportionally and is attached to the embryo by a slight pedicle. The amnion is distended with fluid but is not yet in contact with the chorion (Figs. 103 and 105).

Characteristics of the embryo: The vertex-coccygeal length is about an inch (2.5 cm.), the total length being about the same. Its weight is nearly 60 grains (4 grams). The head is about as large as the trunk. The neck is formed. All the visceral clefts except the first are closed. This latter forms the external auditory meatus, tympanum, and Eustachian tube. The superior and inferior maxillary processes are formed. Bone nuclei appear in the clavicles and lower jaw. The salivary glands and dental groove are formed. There is decrease in the size of the wide oral opening. According to His, the embryo is transformed into the fetus when it has reached a length of about 0.6 to 0.64 inch (15 to 16 mm.); for at this stage the shape of the head and the articulation of the extremities are distinctly of the human type, and the tail has nearly disappeared. The hands and feet are webbed at first. The eyes, ears, and nose can be clearly made out. The brain vesicles, although exhibiting large cavities, are developing and increasing the size of the head. The body begins to straighten a little from the growth of the viscera. The cord is somewhat longer, and although the umbilical ring is contracted to some extent, there are still a few loops of intestine in it. The Wolffian bodies are smaller, but the kidneys and suprarenal bodies are developed. Although the external genitals are now apparent, the sex cannot be distinguished, for the elements of both sexes are equally present (Fig. 81).

End of the Third Month or Twelfth Week.—*Characteristics of ovum.* The ovum is about the size of a goose-egg. It averages $4\frac{2}{5}$ inches (11 cm.) in length. The placenta, though small, is now complete, and the chorion loses its villi except at this point. The amnion is in contact with the chorion.

Characteristics of the fetus: The vertex-coccygeal length of the fetus is 3.2 inches (7 to 8 cm.), while the total length is 4 inches (10 cm.). It weighs about

450 grains (30 grams). The cord, as it lengthens out, begins to make spiral turns, while the umbilical ring narrows and the intestines are now wholly within the abdomen. The sex can be distinguished by the appearance or absence of a uterus. The scrotum and labia majora are composed of skin folds and the penis and clitoris are equal in length. The nails are fine membranes, and the webbed appearance of the fingers and toes disappears. Nearly all the bones present points of ossification. The neck is longer, while the ribs mark the line of division between the abdomen and chest. The palate is formed between the oral and nasal cavities. Teeth are forming and lips close the mouth. The eyes are relatively nearer together and become covered by the lids. The proctodeal or anal opening is perforate (Fig. 82).

End of the Fourth Month or Sixteenth Week.—*Characteristics of the fetus:* The fetus is 3 inches long (7.62 cm.) from coccyx to vertex, the entire length being 5 inches (12.7 cm.). The weight is 1800 grains (120 grams). The placenta continues to grow and the cord becomes more spiral in form. The sex is clearly defined. Lanugo develops. There is meconium in the intestines. The umbilical cord is thicker on account of the beginning formation of Wharton's jelly (Fig. 83).

Vitality: There may be feeble movements of the limbs, and if the child is born it may live some hours, endeavoring during this time to breathe.

End of the Fifth Month or Twentieth Week.—*Characteristics:* The vertex-coccygeal length is 4.5 inches (10.16 cm.), the total length 8 inches (20.32 cm.). The weight is 4095 grains (273 grams). The cord is about 12 inches (30 cm.) long. Here and there are patches of vernix caseosa. The face is wrinkled and has a senile appearance. The eyelids are opening. The head is huge, comparatively. There is more fat on the body (Fig. 134).

Vitality: It is, as a rule, during the fifth month that the mother feels quickening. The fetal heart sounds are audible. If born at this time, the fetus generally dies at once, though it may live a few hours. It may breathe and cry (Figs. 83 and 130).

End of the Sixth Month or Twenty-fourth Week.—*Characteristics:* The fetus is 6.15 inches (15.87 cm.) long from vertex to coccyx, with a total length of 12.20 inches (31.11 cm.). It weighs 1½ pounds (680 grams). The skin is richer in fat, the hair on the head grows. There are distinct brows and lashes. The head is large. The cord is midway between the symphysis and the xiphoid cartilage. The testicles approach the inguinal rings.

Vitality: A fetus born at this time might live for fifteen days, but it would finally die from insufficient air-supply, for the finer air-passages are yet undeveloped. There would also be imperfect assimilation of food and rapid loss of heat.

End of Seventh Month or Twenty-eighth Week.—*Characteristics:* The vertex-coccygeal length is now about 8 inches (20.32 cm.), the total length 14.4 inches (36.19 cm.), and the weight has reached 2½ pounds (1100 grams). The pupillary membrane disappears. There is considerable meconium in the large intestine. Lanugo covers the body except the palms of the hands and the soles of the feet.

Vitality: A child born about this time very seldom survives. However, no effort should be spared to save life, for, according to Lusk, it may be owing to the skepticism of the physician in regard to the viability of these infants that so many have died.

EMBRYO, FETUS, AND UTERUS IN THE SEVERAL MONTHS OF PREGNANCY.

	Period of Pregnancy.		Vertex-coccygeal Length of Fetus.	Total Length of Fetus.	Weight of Fetus.	Biparietal Diameter of Fetus.	Size of Uterus.	Shape of Uterus.
Abortions.	1st month	3d week 4th week	0.177 in. (0.45 cm.) 0.31 to 0.43 in. (0.8 to 1.1 cm.)		(?)		3½ × 2½ × 2½ ins. (8.75 × 6.25 × 6.25 cm.)	Marked antero-posterior growth. Pyriform shape.
	2d month	5th week 6th week 7th and 8th weeks	0.33 to 0.5 in. (0.85 to 1.28 cm.) 0.51 to 0.67 in. (1.3 to 1.7 cm.) 0.63 to 0.82 in. (1.6 to 2.1 cm.)		(?)		4¼ × 3½ × 2 ins. (10.63 × 8.75 × 5 cm.)	Pyriform shape still preserved but almost cylindrical.
	3d month	12th week	0.82 to 2.68 in. (2.1 to 6.8 cm.)	2.75 to 3.54 in. (7 to 9 cm.)	77.16 to 308.64 gr. (5 to 20 grams)		5 × 4 × 3 ins. (12.5 × 10 × 7.5 cm.)	Pyriform shape disappearing. Shape now nearly spherical.
Immature Labors (Miscarriages).	4th month	16th week	2.71 to 3.54 in. (6.9 to 9.0 cm.)	3.94 to 6.69 in. (10 to 17 cm.)	1.94 to 4.23 oz. (55 to 120 grams)		6 × 5 × 4 ins. (15 × 12.5 × 10 cm.)	Marked ovoid. Anterior surface rounded like a ball. Posterior surface flattened. Tubes below horns.
	5th month	20th week	3.82 to 5.79 in. (9.7 to 14.7 cm.)	7.08 to 10.62 in. (18 to 27 cm.)	9.8 oz. (280 grams)		7 × 6 × 5 ins. (17.5 × 15 × 12.5 cm.)	Shape same as at end of fourth month.
	6th month	24th week	5.9 to 7.36 in. (15.0 to 18.7 cm.)	11.02 to 13.48 in. (28 to 34 cm.)	1.395 lbs. (634 grams)		8½ × 6½ × 6 ins. (21.25 × 16.25 × 15 cm.)	Ovoid of 4 and 5 months gradually becoming egg-shaped. Posterior wall flattened by spinal column. Tubes well below horns.

7th month	28th week	7.08 to 8.97 in. (18.0 to 22.8 cm.)	13.88 to 14.96 in. (35 to 38 cm.)	2.64 lbs. (1200 grams)	2¾ in. (6.98 cm.)	10½ × 7½ × 6½ ins. (26.25 × 18.75 × 16.25 cm.)	Distinctly egg-shaped. Broadest portion just below fundus. Longitudinal axis predominates. Posterior surface flattened by spinal column. Tubes well below horns.
8th month	29th week 32d week	9.45 to 10.82 in. (24 to 27.5 cm.)	14.96 to 16.93 in. (38 to 43 cm.)	3.52 to 4.18 lbs. (1600 to 1900 gm.)	2¾ in. (6.98 cm.)	11½ × 8½ × 7 ins. (28.75 × 21.25 × 17.5 cm.)	Shape same as at end of seventh month.
9th month	34th week 36th week	10.63 to 11.81 in. (27 to 30 cm.)	16.52 to 18.9 in (42 to 48 cm.)	3.74 to 5.72 lbs. (1700 to 2600 grams)	3 in. (7.62 cm.) 3¼ in. (8.25 cm.)	13 × 9½ × 8½ ins. (32.50 × 23.75 × 21.25 cm.)	Ovoid shape. Longitudinal axis predominates. Fundus broad. Posterior depression caused by lumbo-sacral angle.
10th month	37th week 40th week	11.81 to 14.56 in. (30 to 37 cm.)	18.9 to 20.47 in. (48 to 52 cm.)	6.60 to 7.92 lbs. (3000 to 3600 gm.)	3½ in. (8.89 cm.) 3¾ in. (9.52 cm.)		Ovoid shape. Fundus rarely regular and depends on posture of fetus. Fetal head causes increased development of anterior part of lower portion of uterus, causing sacciform dilatation of lower uterine segment.

End of the Eighth Month or Thirty-second Week.—*Characteristics:* The vertex-coccygeal length is 10.20 inches (26.03 cm.), the entire length 15.80 inches (40 cm.), the weight is $3\frac{1}{2}$ pounds (1571 grams). The lanugo on the face is becoming more scanty, but the hair on the scalp is thicker. One testicle, generally the left, has descended into the scrotum. In the lower epiphysis of the femur ossification begins. The nails do not yet project beyond the finger-tips, although they are firmer in consistency. The cord is relatively a little lower in its insertion than it was the previous month.

Vitality: With very watchful care a child born at this time may survive.

End of the Ninth Month or Thirty-sixth Week.—*Characteristics:* The vertex-coccygeal length is 11.10 inches (27.94 cm.), the total length 17.25 inches (44 cm.), and the weight is $5\frac{1}{2}$ pounds (2640 grams). There is a further increase in the subcutaneous fat. The development of the nails is not yet complete. The cranial bones are compressible and very susceptible to moulding. The diameters of the head are about 0.4 to 0.6 inch (1 to 1.5 cm.) less than those of the average fetus at full term (Fig. 109).

Vitality: With ordinary care the fetus almost invariably survives.

End of the Tenth Month or Fortieth Week.—*Characteristics:* The vertex-coccygeal length is 14.8 inches (37 cm.), the total length 19.84 inches (50 cm.), and the weight 7 pounds (3200 grams). The skin is pink, but paler, more abundantly supplied with fat, and has less lanugo. The nails are perfectly developed and project beyond the finger-tips. The eyes are opened. The ossification center in the lower epiphysis of the femur is 0.2 inch (5 mm.) in diameter, and that of the cuboid bone is just making its appearance. The diameters of the skull are normal (Fig. 138). (See Physiology of Labor, Part IV.)

Embryo, Fetus, and Uterus in the Several Months of Gestation.—Although it is customary to measure embryos from vertex to sole, measurement of the trunk (or, in youngest embryos, the two extreme points) is doubtless more exact. During the first and second months only the trunk can be measured, and in the third and fourth months the legs cannot readily be extended. The notable differences of various authorities may be explained in part by the fact that embryos preserved in alcohol diminish in weight from 3 to 5 per cent. on an average (1 to 14 per cent. extremes) according to the strength of the fluid; and in part by fluctuations in the estimation of the age. Exact data upon these points are entirely wanting. It is best to be guided in judging the age by certain developmental signs, such as growth of lanugo in each month, etc. In the table on pages 86 and 87 the vertex-coccygeal lengths of the embryo and fetus are from Schultze's figures.* The weights are those of Droysen and Göttengen and the size and shape of the uterus are the author's estimates. The last measurements, it must be remembered, are influenced by the presentation, size, and number of the fetus, by the size and position of the placenta, by the amount of liquor amnii, and by pathological conditions.

* Schultze: "Grundriss der Entwicklungsgeschichte des Menschen und der Säugethiere," Leipzig, 1897, p. 137.

II. THE PHENOMENA PRODUCED IN THE MATERNAL ORGANISM BY PREGNANCY.

LOCAL PHENOMENA IN THE GENITAL TRACT, ADNEXA, PELVIS, AND BREASTS.

1. External Genitals.—The vulva takes part in the general hyperemia of the generative system, though these changes are rarely apparent until the third month. The labia majora and minora are both increased in size, are more elastic and resisting, and there is a deeper pigmentation than normal, which is particularly marked in the external labia. The functional activity of the sebaceous follicles and sweat glands of the labia is increased, and the external genitals are later often bathed with a glairy mucous secretion. Somewhat later still in pregnancy the veins and venous plexuses are much engorged, while distinct varicosities are not uncommon.

2. Vagina.—The muscular and mucous walls of the vagina are thickened and lengthened. This hypertrophy is particularly well marked at the upper portion. The walls are consequently strengthened, so as better to accommodate the passage of the fetus at term. The mucous membrane becomes darkened by pigmentation. The attachment of the mucous coat to the tissues beneath becomes loosened, so that its displacement is easy, and it is not infrequently torn off in labor, thus originating vaginal prolapse. The rugæ are distinctly defined; the lymphatics, as well as the blood-vessels, are unusually developed; the tissues become softened and infiltrated, and the submucous fat decreases. On account of the increased quantity of blood in the loose tissues, as well as the venous stagnation which occurs, the vaginal surface looks violet, blue, or purple, instead of red as normally (Fig. 7). The mucous glands produce an abundant secretion, the papillæ of the vagina hypertrophy, and it is not uncommon about the seventh or eighth month to find the surface covered throughout its whole extent with myriads of these little pinhead prominences, which have given rise to the term "granular vaginitis of the pregnant woman." The temperature of the vagina is slightly increased, and the augmented supply of blood to the part causes a distinct throbbing of the vaginal arteries, readily detected by the examining finger, the so-called "vaginal pulse." The apparent length of the vaginal canal varies according to the period of pregnancy at which the examination takes place. In the early weeks, before the uterus rises above the pelvic brim, the vagina is shortened; afterward it increases in length till the middle of the eighth month (as a result of the sinking of the uterus at this time), when it again becomes shortened.

3. Cervix.—(1) CONSISTENCY: The tissue of the non-gravid uterus is firm, hard, and non-elastic. With the occurrence of conception, softening begins at the external os, and gradually extends upward till the whole cervix is involved. It is caused by serous infiltration, with which passive dilatation of the blood-vessels is associated. At the end of the fourth month the lips of the os are entirely changed in consistence, being soft and velvety on palpation. By the sixth month one-half of the cervix has participated in this change, and by the eighth the entire cervix is involved.

2. VOLUME.—The cervix takes part in the hypertrophy of the entire uterus, its volume changing somewhat as pregnancy advances. This increase, however, does not compare in extent with that of the body of the uterus.

3. SITUATION AND DIRECTION.—In the first three months the cervix is

lower in the pelvis and a trifle to the left. This position results from the increased weight and the pressure upon the fundus toward the right by the distended rectum. After the third month the cervix rises higher in the pelvis

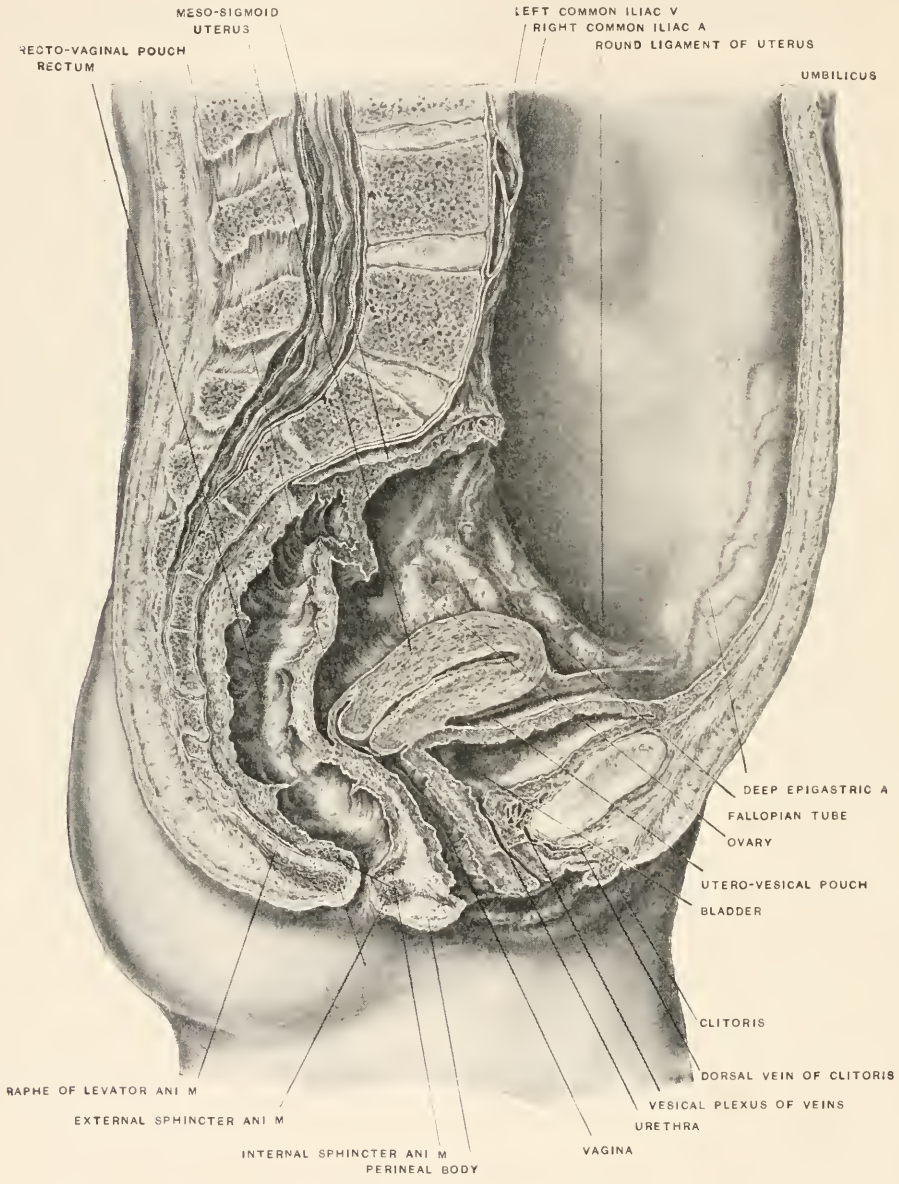

FIG. 117.—SAGITTAL SECTION OF NORMAL ADULT PELVIS.—(*Deaver.*)

till the last two or three weeks of gestation, when it sinks again. Sometimes toward the end of pregnancy, if the head is the presenting part, it pushes forward the lower anterior wall of the uterus, causing the cervix to point backward,

or even a little upward.* The cervix changes in direction according to the movements of the uterine body.

4. Cervical Canal.—Coincident with the cervical softening, the cavity becomes broader, and the external os patulous. The time of this change varies according as the patient is a primigravida or a multigravida. Sometimes, in the former case, the external os remains closed till the end of pregnancy; but even under these circumstances it generally becomes patulous after the seventh month. In multigravidæ this change is more pronounced, so that in the last months of gestation it is often possible to feel the membranes through the

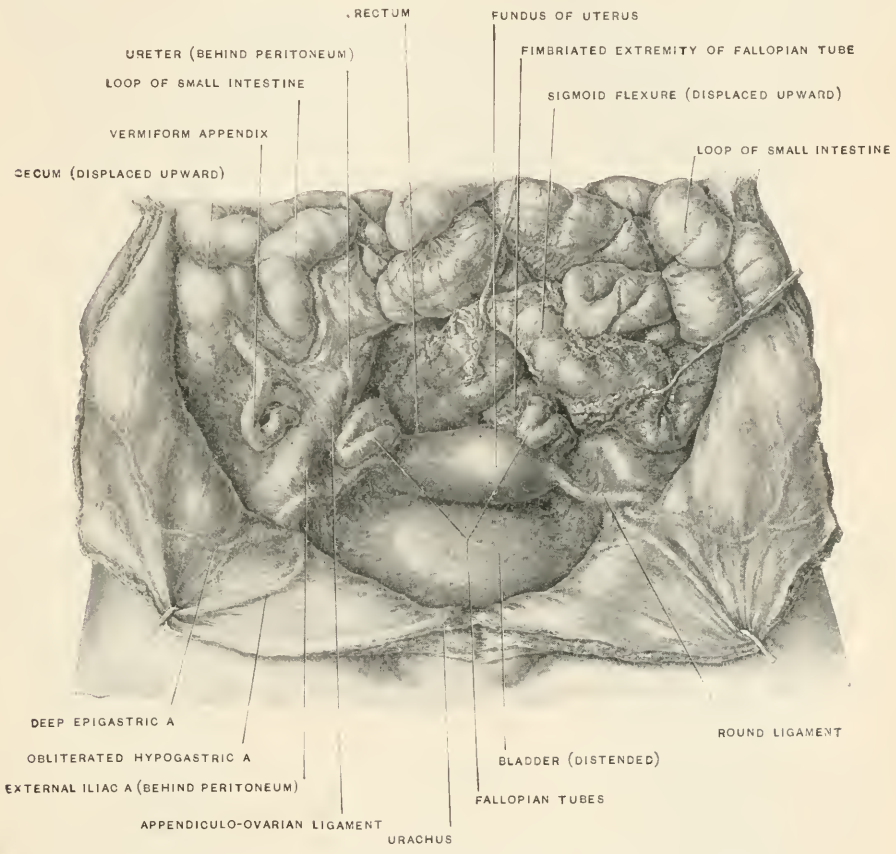

Fig. 118.—Pelvic Contents seen from Above.—(*Deaver.*)

patulous os. The alleged shortening of the cervix, as taught by old authorities, has been shown to be non-existent; but during the two weeks just preceding labor some shortening does begin to take place, proceeding from above downward till the cervical canal is merged into the uterine cavity; this shortening is owing to the incipient contractions of the uterus which are preparing the cervix for labor.

4. Uterus.—The most important changes in the whole organism during pregnancy take place in the uterus. The alterations which the latter undergoes

* Sacciform dilatation of the lower uterine segment.

as the result of each menstrual period must be regarded as an introduction to that series of changes which end only with the return of the organ to its normal condition after the expulsion of the product of conception (see Menstruation, page 20).

1. Volume and Size.—The volume or size of the small, inflexible virgin uterus is expressed by $2\frac{3}{4}$ inches (7 cm.) in length, $1\frac{3}{4}$ inches (4.5 cm.) in breadth,

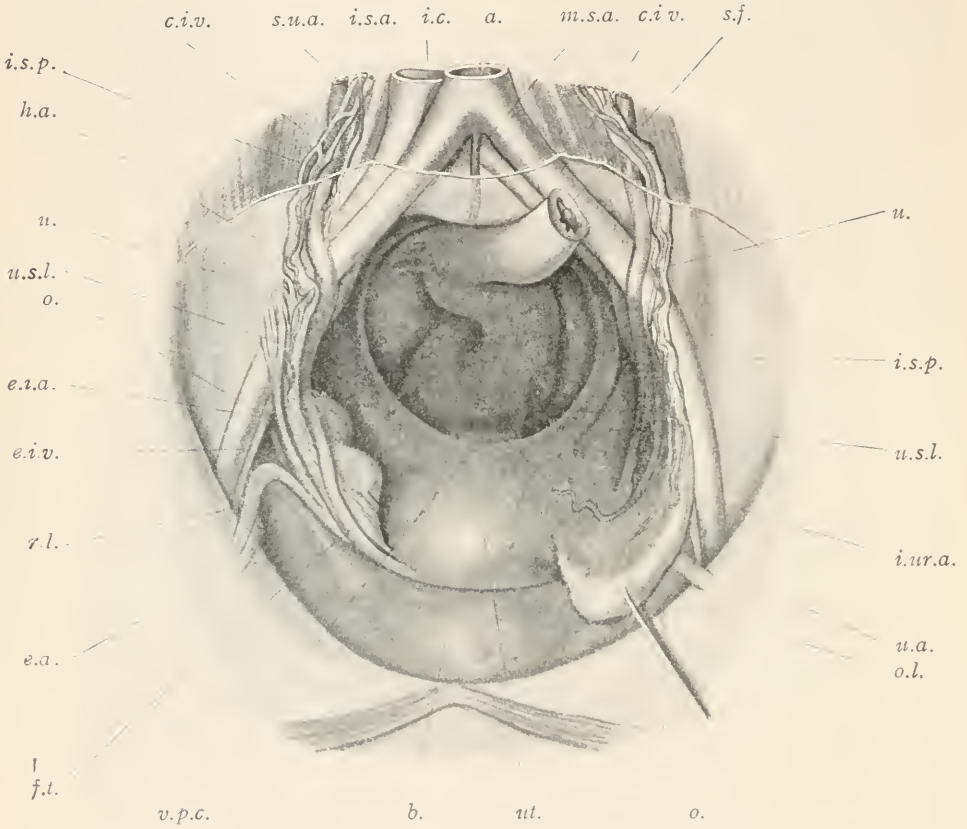

Fig. 119.—The Pelvic Inlet and Female Pelvic Organs in a Woman Forty Years Old, Who has borne Children. The bladder is partially filled with urine. ($\frac{1}{4}$ natural size.) *i.s.a.*, Internal spermatic artery; *s.u.a.*, superior ureteric artery; *c.i.v.*, common iliac vein; *i.s.p.*, internal spermatic plexus; *h.a.*, hypogastric artery; *u.*, ureter; *u.s.l.*, utero-sacral ligament; *o.*, *o.*, ovary; *e.i.a.*, external iliac artery; *e.i.v.*, external iliac vein; *r.l.*, round ligament; *e.a.*, epigastric artery; *f.t.*, Fallopian tube; *v.p.c.*, vaginal portion of cervix; *i.c.*, inferior cava; *a.*, aorta; *m.s.a.*, median sacral artery; *c.i.v.*, common iliac vein; *s.f.*, sigmoid flexure; *u.*, ureter; *u.s.l.*, utero-sacral ligament; *u.a.*, uterine artery; *o.l.*, ovarian ligament; *ut.*, uterus; *b.*, bladder; *i.ur.a.*, inferior ureteric artery.—(*Tandler and Halban.*)

and 1 inch (2.5 cm.) in thickness. The hypertrophy of the uterus is concerned not only with the muscle-fibers, but with the connective tissue and all the vessels. These changes are reflex in character, and begin with impregnation. Indeed, the uterus increases up to the fourth month, even in tubal or any form of extrauterine pregnancy. The growth of the ovum may act at first as a physiological cause of these changes, but not as a mechanical one. Uterine enlargement is not directly dependent upon the presence of the ovum, for the

latter does not entirely fill the cavity of the organ at the end of the fifth month; consequently it is not until this time that mechanical distention can be reckoned as an influential factor. At first this hypertrophic process affects all parts

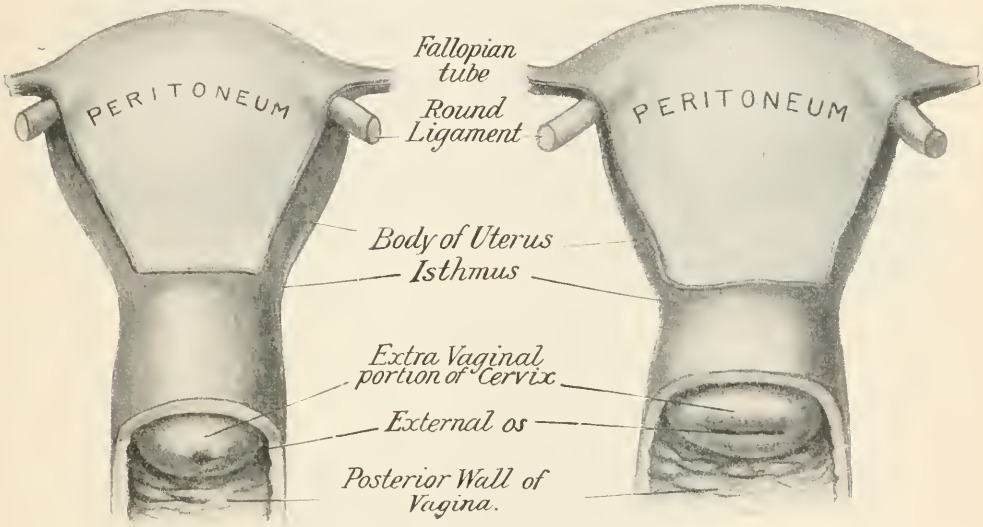

FIG. 120.—THE ANTERIOR SURFACES OF THE NULLIPAROUS AND MULTIPAROUS UTERUS COMPARED.

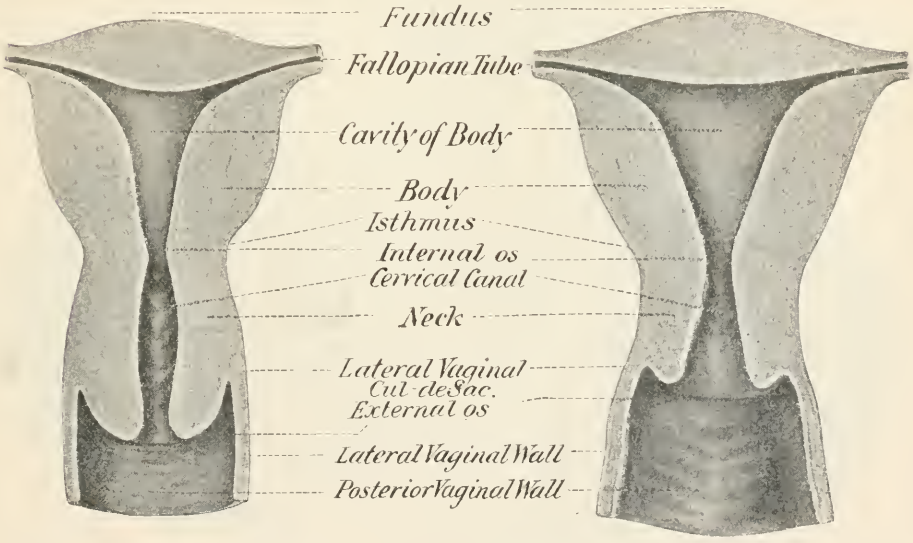

FIG. 121.—SAGITTAL SECTIONS OF THE NULLIPAROUS AND MULTIPAROUS UTERUS.

of the organ alike, but later the cervix grows more slowly than do the fundus and the body. At one period the walls attain the thickness of five-eighths of an inch (1.5 cm.). The thickness, however, decreases in the latter part of gesta-

tion, on account of extreme distention, to three-sixteenths of an inch (0.5 cm.). The capacity of the virgin uterus, which is almost imaginary, may be

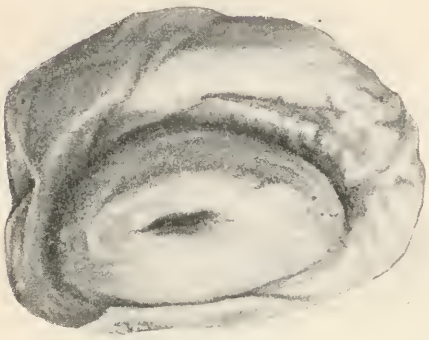

FIG. 122.—VIRGIN CERVIX AND OS WITH OVAL OPENING.

FIG. 123.—VIRGIN CERVIX AND OS WITH TRANSVERSE FISSURE.

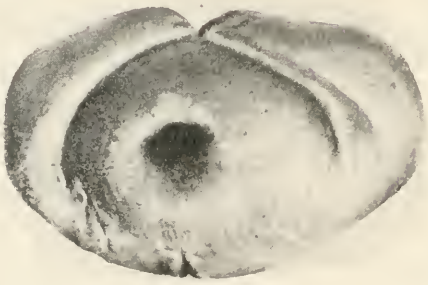

FIG. 124.—VIRGIN CERVIX AND OS WITH OVAL OPENING.

FIG. 125.—MULTIPAROUS CERVIX WITH GAPING FISSURED OS.

FIG. 126.—CERVIX AND OS OF ADVANCED AGE WITH SMALL ROUND OPENING.

increased as much as 519-fold at term (Krause, Levret). The outer surface of the virgin uterus measures six square inches, while at term it amounts to

339 square inches. The unimpregnated uterus weighs about 1¼ ounces (35.43 gm.), while the pregnant organ at term weighs about two pounds (900 gm.).

FIG. 127.—SAGITTAL SECTION OF UTERUS AND PELVIC CONTENTS AT THE SECOND MONTH OF PREGNANCY. RETROVERSION. (½ natural size.)—(*Schaeffer.*)

FIG. 128.—SAGITTAL SECTION OF UTERUS AND PELVIC CONTENTS AT THE THIRD MONTH OF PREGNANCY. Unusual vertical position of the gravid uterus. (⅓ natural size.)—(*Schaeffer.*)

FIG. 129.—FROZEN SECTION OF A UTERUS AT THE THIRD MONTH. Uterus resting normally on the bladder. Placenta and membranes in the uterus.—(*Freund.*)

FIG. 130.—SAGITTAL SECTION OF UTERUS AND PELVIC CONTENTS AT THE FOURTH MONTH OF PREGNANCY. Primigravida. Breech presentation. Normal position of the uterus. (⅓ natural size.)—(*Schaeffer.*)

FIG. 131.—FROZEN SECTION OF A UTERUS AT THE FOURTH MONTH OF PREGNANCY. Placenta and membranes are retained. —(*Freund.*)

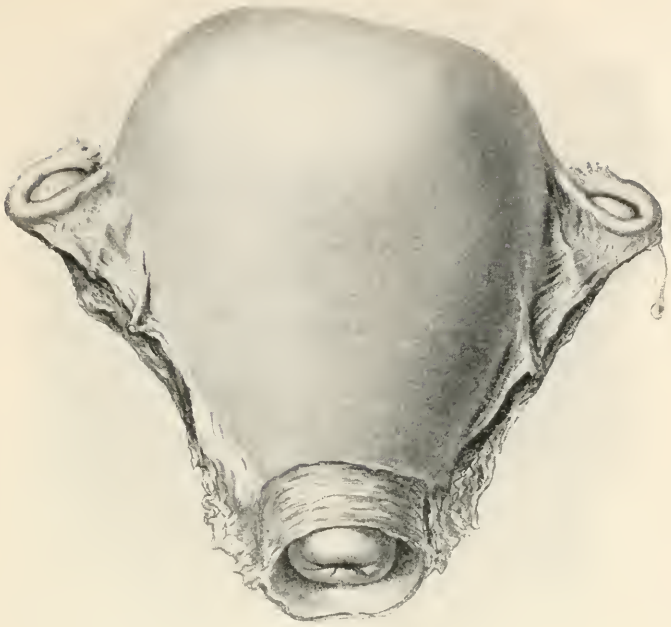

Fig. 132.—Pregnant Uterus at the Fifth Month, showing Anterior Surface and Prominent Right Horn (Unicornate Uterus).—(*Author's case.*)

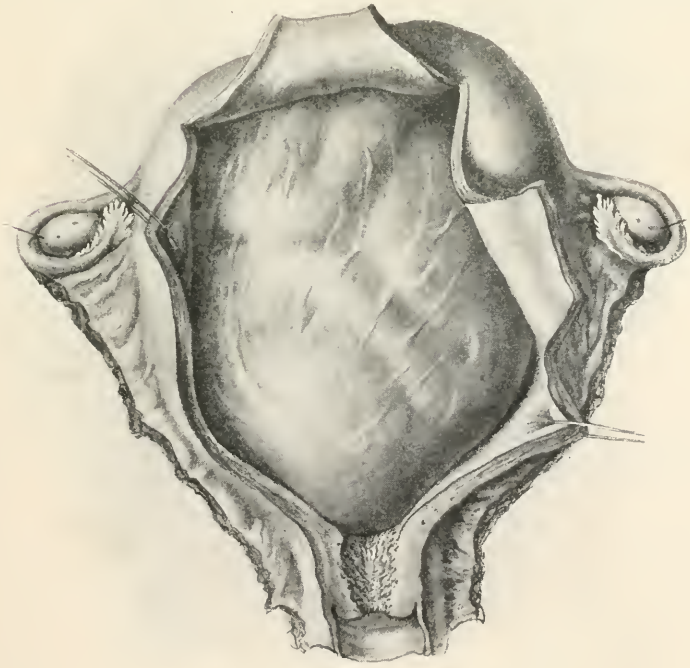

Fig. 133.—Uterus of Fig. 132 Opened Posteriorly, showing Unruptured Amnion with Contained Fetus, Thickness of the Uterine Walls, and Length of Uterine Canal.—(*Author's case.*)

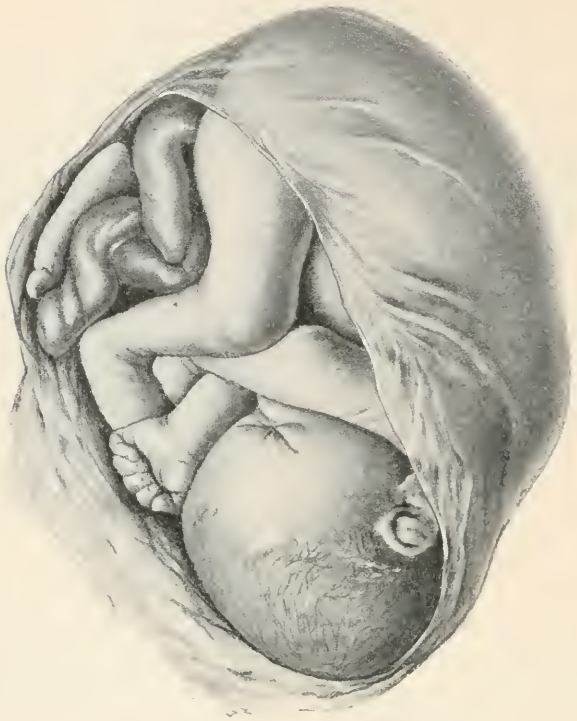

FIG. 134.—AMNION AND FETUS FROM FIG. 133 AFTER ENTIRE SPECIMEN WAS HARDENED IN FORMALDEHYDE. Shows posture of fetus and shape of the fetal ovoid.—(*Author's case.*)

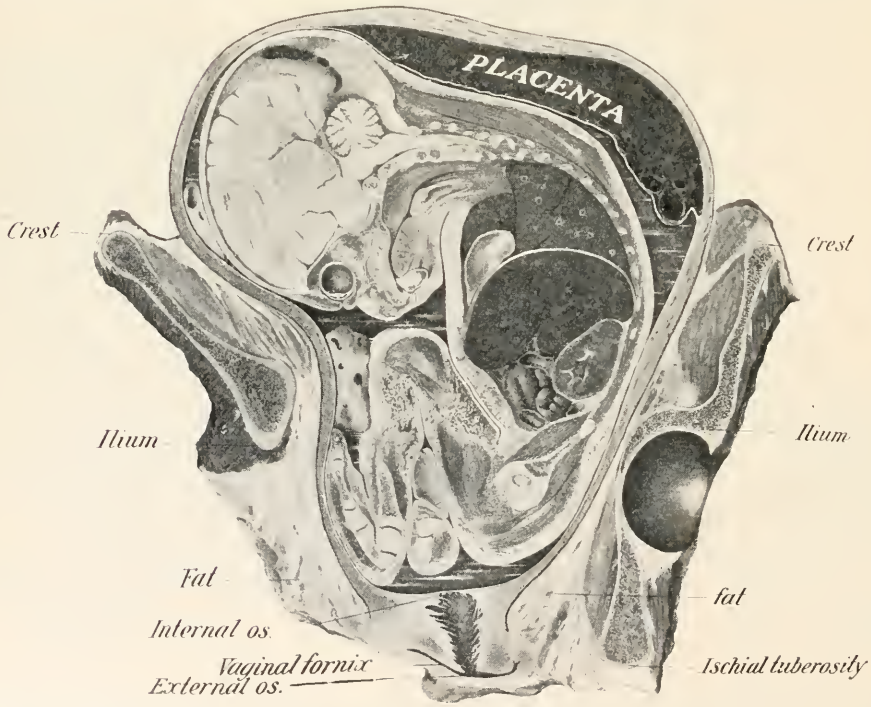

FIG. 135.—FROZEN TRANSVERSE SECTION OF A UTERUS FROM A MULTIGRAVIDA AT TH THIRTY-SIXTH WEEK. No uterine contractions have occurred. The cervix is close and the canal unshortened. Death from eclampsia. (⅓ natural size.)—(*Leopold.*)

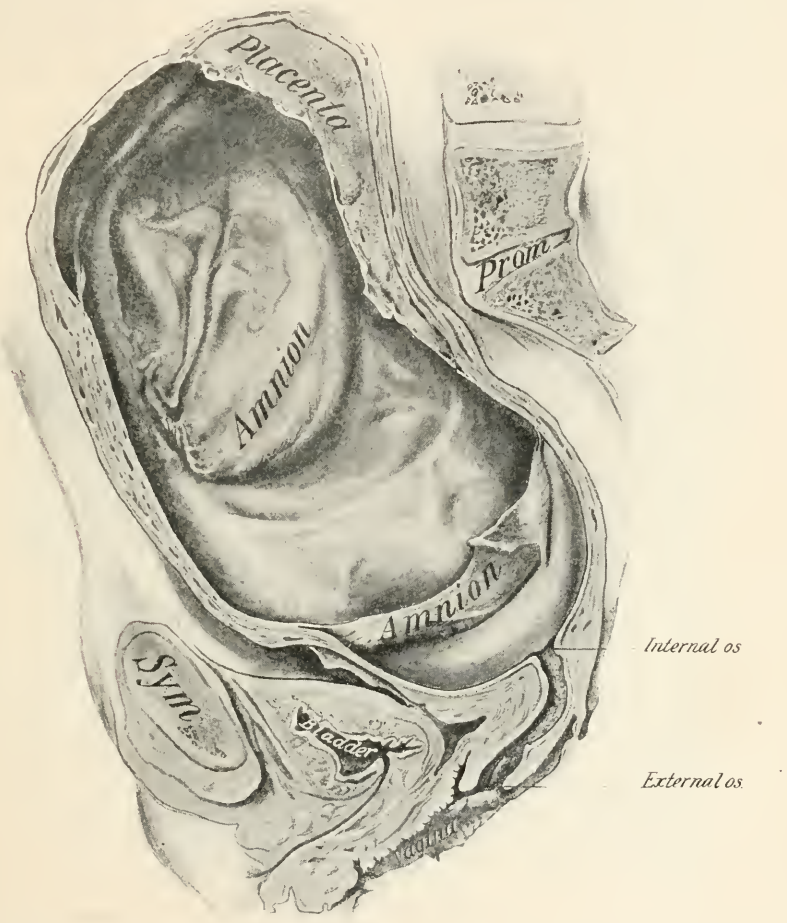

Fig. 136.—Frozen Section of a Uterus at the Seventh Month, with Retained Placenta and Membranes.—(*Freund.*)

For the size of the uterus at the end of each calendar month see table, pages 86 and 87.

2. Shape.—The virgin uterus is pyriform or pear-shaped, flattened from before backward (Fig. 120). Its upper end or fundus, the broad extremity of the organ, is directed upward and forward (Fig. 119). Its lower end, or apex, looks downward and backward. Consequently it forms an angle with the vagina. During the first six or eight weeks of gestation the organ loses its

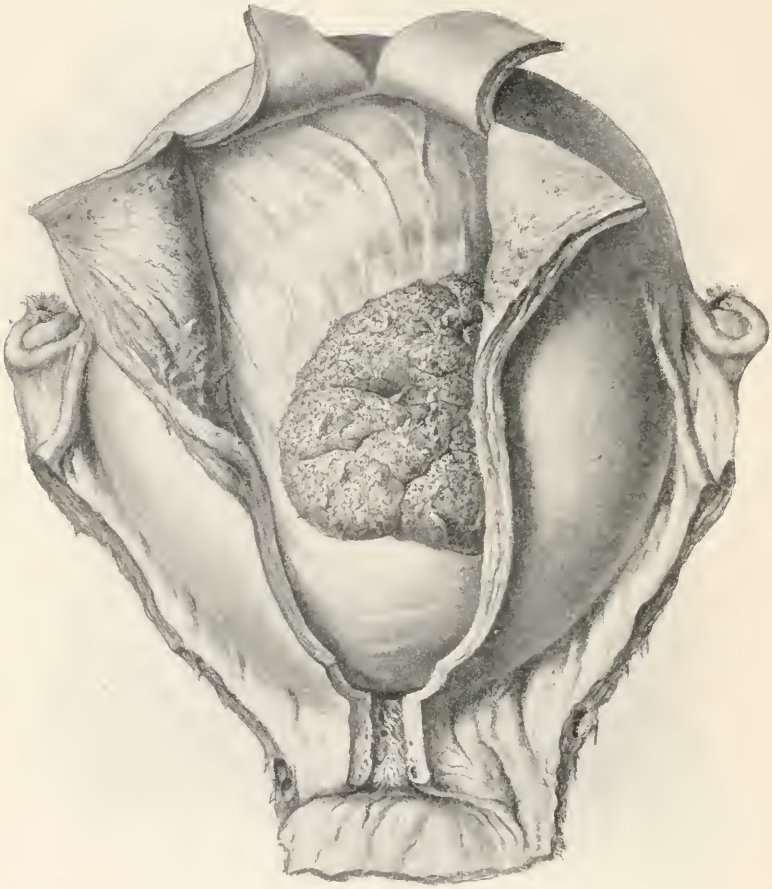

Fig. 137.—Pregnant Uterus at Thirty-eighth Week seen from the Front. Anterior walls are held back to show the maternal surface of the placenta, the unruptured amnion, thickness of the uterine walls, and the length of the cervical canal.—(*Author's case.*)

flattened pear shape and bulges out over the cervix, in all the transverse diameters, but more particularly antero-posteriorly; so that now the uterus resembles very much an old-fashioned jug inverted (Fig. 169). Later it expands more in the lower segment, and by the fifth month its form is midway between spherical and pyriform, the vertical diameter being longest (Fig. 132). Its antero-posterior measurement is greatest just below the middle of the body. During the last of pregnancy it becomes egg-shaped, ovoid, or cylindrical (Fig. 137). These changes in shape occur in the normal uterus, but may be influenced by

multiple pregnancies, by anomalies of the liquor amnii, and by pathological conditions. Asymmetry of the corpus uteri often exists even at a very early period of pregnancy (Figs. 132, 139 to 143). Fig. 132 of the author's collection shows this condition. The bulging portion is often marked off from the rest of the corpus by a furrow (Fig. 163) (compare Diagnosis of Pregnancy).

The shape of the uterus at the end of each calendar month is as follows: End of first month, pyriform, by reason of marked antero-posterior growth, changing to cylindrical; second month, exaggeration of first month, spherical form suggested; third month, almost spherical; fourth month, marked ovoid

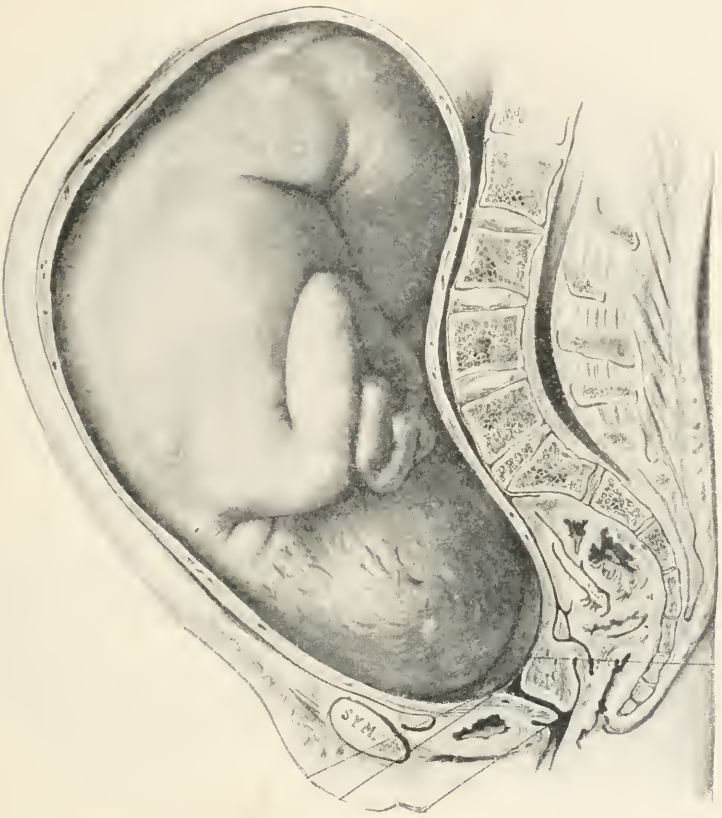

FIG. 138.—FROZEN SECTION OF UTERUS FROM A PRIMIPARA AT THE FORTIETH WEEK. Uterine contractions have just commenced. Death from eclampsia. Note the unshortened cervical canal and the lateral flexion of the body and head of the fetus. (⅓ natural size.)—(*Leopold.*)

with round anterior and flattened posterior surfaces; fifth month, exaggeration of fourth month; sixth month, ovoid changing to egg-shape with posterior wall flattened by spinal column; seventh month, egg-shaped, broadest just below fundus; eighth month, exaggeration of seventh month, lower portion widening out; ninth month or full term, ovoid shape with predominance of longitudinal axis; anterior surface more convex, with marked bulging of anterior part of lower uterine segment, caused by fetal head. A posterior depression caused by the lumbo-sacral angle and fundus may be due to irregular posture of the fetus.

3. Situation or Position.—On account of increased weight, the uterus, in the early months of pregnancy, sinks down into the pelvic cavity. After the third month it rises gradually, till it almost touches the diaphragm, and before term it sinks again by reason of the engagement of the lower part of the uterus in the pelvic cavity, and the relaxation of soft parts preceding delivery. This is called the "lightening" before labor. The virgin uterus is normally anteflexed (Fig. 117). This condition becomes much accentuated in pregnancy, especially when the abdominal walls are lax, as after the patient has borne a number of children, when anteflexion is much exaggerated. Not only does

Fig. 139.—Egg-shaped Uterus.

Fig. 140.—Cylindrical-shaped Uterus.

Fig. 141.—Unicornate-shaped Uterus.

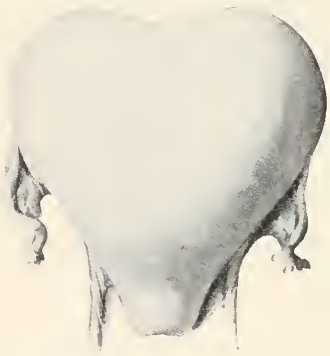

Fig. 142.—Bicornate-shaped Uterus, Uterus Arcuatus.

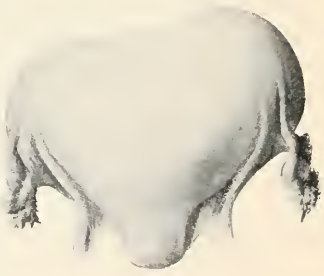

Fig. 143.—Oblique Cylindrical-shaped Uterus in Shoulder Presentation.

the sinking of the organ depend upon its increase in weight, but also on the greater surface of the fundus exposed to the downward pressure of the intestines. Before the pregnant uterus has risen out of the pelvis, the abdomen is not increased in size. In fact, it is often said to be flatter, on account of the partial descent of the uterus into the pelvis. About the middle of the third or beginning of the fourth month, however, the fundus slowly rises above the pelvic brim, and it may then be felt as a smooth, rounded tumor.

4. Axis.—While the uterus is in the pelvic cavity its longitudinal axis changes from time to time, like that of the nonpregnant organ. These alterations in

direction probably depend on the condition of the bladder. Later on in pregnancy, when the uterus has extended up into the abdomen, it tends to tilt forward against the abdominal wall, and its axis corresponds more nearly with that of the pelvic brim, the angle formed with the horizon being 30 degrees. At term, the position and relations of the uterus vary with the posture of the woman. While upright, the heavy fundus inclines forward against the abdominal parietes, as far as the consistency of the latter will permit. In the recumbent position, the uterus rests against the spinal column in the lumbar region, while the fundus approaches the diaphragm, and the intestines are massed around the organ in front and at the sides, particularly the left side (Fig. 160). In either lateral position the uterus naturally inclines to the corresponding side. In women with very lax abdominal parietes the fundus may even hang downward, there not being sufficient support from the flaccid muscles of the abdomen (Fig. 151). Besides the anterior obliquity, there is also a right lateral obliquity, to explain which many theories have been advanced (Fig. 160). Rotation (torsion) on its longitudinal axis is often noticed, so that the ovaries are displaced, the left generally lying toward the middle line and forward, while the right is directed backward (Fig. 160). The cervix naturally follows in the wake of the larger body. In extreme anteflexion it cannot always be felt.

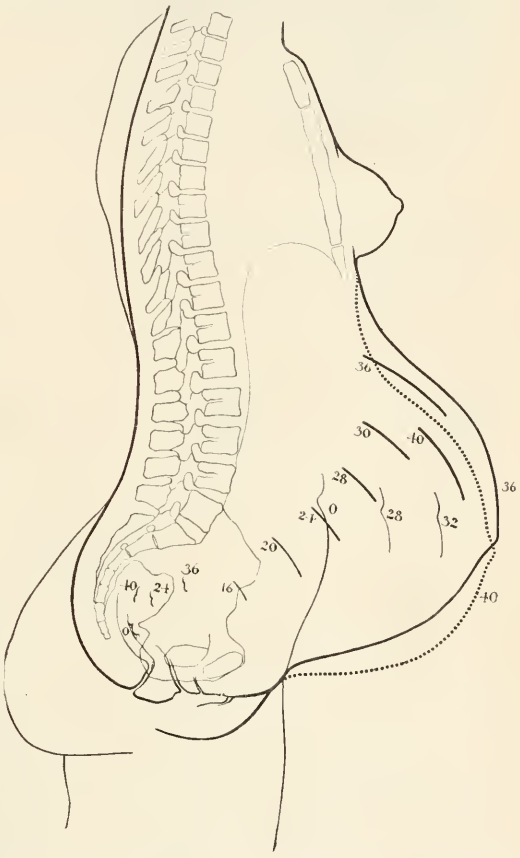

FIG. 144.—HEIGHT OF THE FUNDUS AND POSITION OF THE CERVIX IN THE SEVERAL WEEKS OF GESTATION.

5. CONSISTENCY.—The consistency of the pregnant uterus changes from the rigid, firm, inelastic condition of the non-pregnant organ to the soft, elastic consistency which increases with the advance of pregnancy An obscure sense of fluctuation is often perceived. This consistency differs from that of metritis, which causes a hard and non-elastic uterus; from that of subinvolution, which gives a soft but inelastic consistency to the organ; and from that of fibroid, which is also hard and inelastic. So, at term, the full-grown fetus is contained within a flexible-walled cavity.

6. MUCOUS MEMBRANE.—(See Decidua, page 45.)

7. MUSCULAR LAYERS.—In the non-pregnant uterus the muscle-fibers have a very irregular distribution. Roebger has done very important work on this subject, and says that we do not find definite layers of muscles. Much discussion has taken place as to the musculature of the pregnant uterus. Luschka

and Henle's work is as good as any. They believe the pregnant uterus to consist of three layers: (1) An external or hood-like, longitudinal layer, passing over from the fundus of the uterus and continuing into the ligaments (Fig. 152). (2) A median layer, where the network of fibers attains its greatest thickness (Fig. 154). (3) An internal layer, which forms the sphincters about the uterine orifices—tubes and os uteri (Fig. 153). These chief layers are connected by communicating groups, so that when they are separated the intervening spaces are rhomboidal in shape. The connective tissue between the muscle-fibers

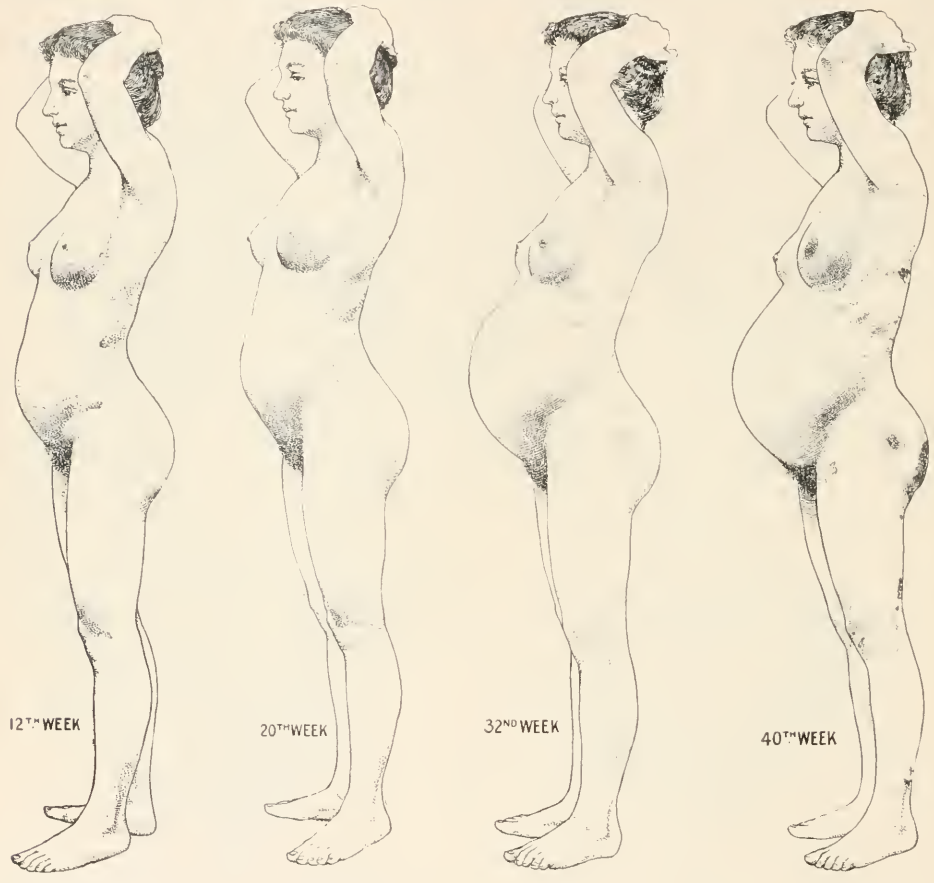

Fig. 145. Fig. 146. Fig. 147. Fig. 148.

FIGS. 145–148.—SHAPE OF THE ABDOMEN IN A PRIMIGRAVIDA.—(*Redrawn from Hirst's photographs.*)

soon becomes increased, and toward the last of pregnancy exhibits distinct fibrillæ (Ruge, Hofmeier). By hypertrophy and hyperplasia the three muscular layers are defined. The hypertrophy of the single muscle-fibers is perhaps the most striking change in the whole organism, the increase being eleven times in length and five times in width. The new muscular elements rapidly grow as well.

8. FIBROUS TISSUE.—The fibrous tissue is increased, chiefly by absorption of fluid and consequent increase in bulk, and it sends in its newly developed

Fig. 149.—Shape of the Abdomen in a Young Primigravida at Full Term after the Falling of the Uterus and in the Dorsal Posture.

Fig. 150.—Shape of the Abdomen in a Young Primigravida at Full Term after the Falling of the Uterus and in the Standing Posture.

fibers between the muscle bundles, thus adding its influence to the other factors which change the consistency of the uterus in the gravid state.

9. Arteries and Veins.—The arteries increase in calibre and length. Their tortuosity is not lost. The veins enlarge into wide channels, the *sinus uteri*. These penetrate between the muscle bundles and are especially well developed at the placental site. The walls of these channels do not collapse when injured,

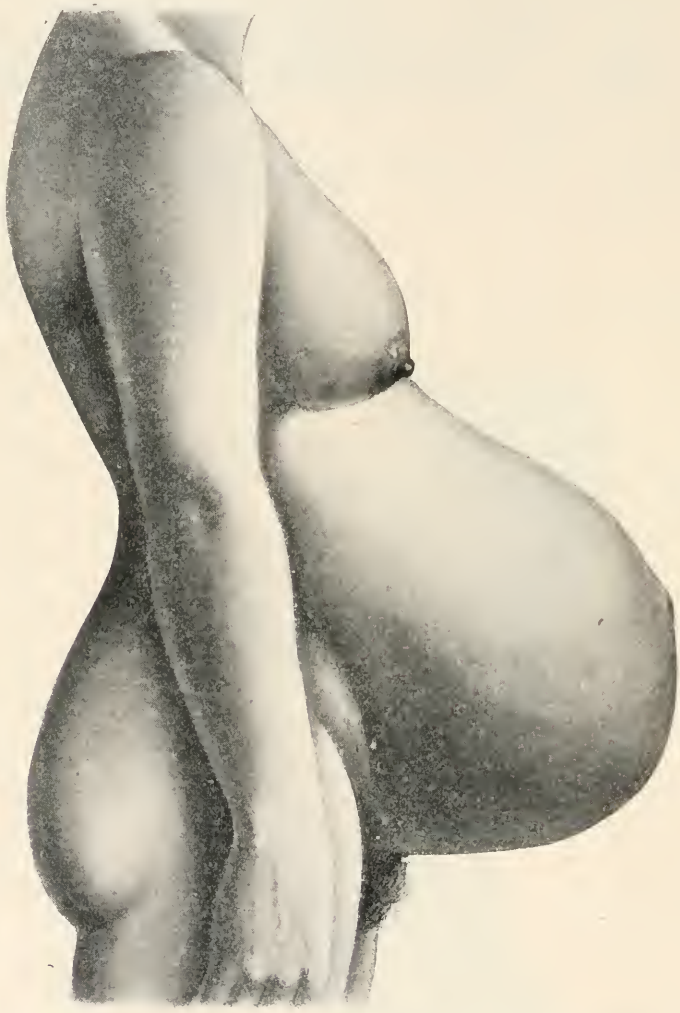

Fig. 151.—Shape of the Abdomen in a Multigravida with a Moderate Generally Contracted Pelvis at the Thirty-eighth Week and in the Standing Posture.

on account of the close connection between them and the surrounding connective tissue. They are obliterated after labor by the contraction of the uterine muscle, which surrounds them. These blood-vessels penetrate the minutest divisions of the chorion frondosum, and consist of the end ramifications of the umbilical arteries and veins. The arteries and veins pursue their course side by side, a distinguishing characteristic of the latter being their thin walls and

large calibre. Only capillaries occupy the terminal villi. They are, as a rule, just under the epithelium, and are connected by free anastomoses. They are so abundant that this area has the appearance of a saturated sponge. Their

FIG. 152.—EXTERNAL MUSCULAR LAYER OF THE PREGNANT UTERUS. ANTERIOR SURFACE. 1, Fallopian tube. 2, Round ligament. 3, Ovarian ligament. 4, Transverse fibers. 5, Longitudinal fibers. 6, Z-shaped arrangement of fibers. 7, Orifice of external os.—(*Henle.*)

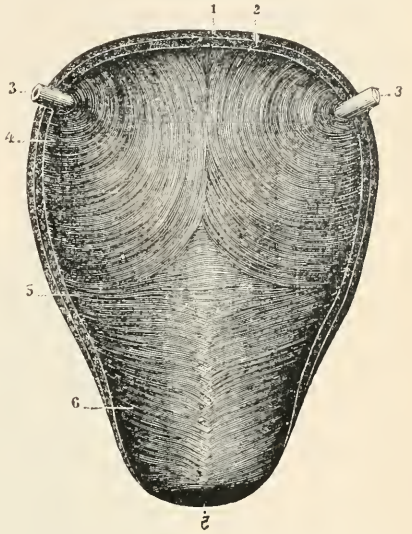

FIG. 153.—INTERNAL MUSCULAR LAYER OF THE PREGNANT UTERUS AFTER REMOVAL OF THE TWO OUTER LAYERS. 1, Section of the external layer. 2, Section of the middle layer. 3, Fallopian tubes. 4, Circular fibers of the horns. 5, Circular fibers of the isthmus. 6, Circular fibers of the cervix. 7, Orifice of the external os. —(*Henle.*)

diameter is large enough to accommodate five or six red corpuscles side by side. They have a delicate endothelial wall, which, together with the chorionic epi-

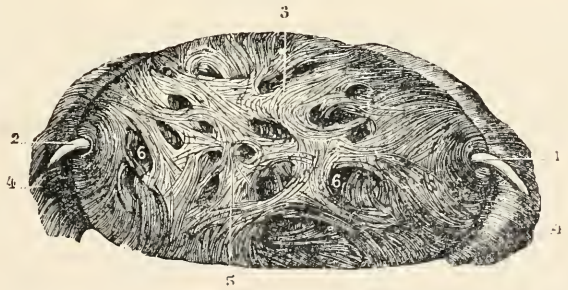

FIG. 154.—MIDDLE MUSCULAR LAYER OF THE PREGNANT UTERUS. 1, Left tube. 2, Right tube. 3, Fundus uteri. 4, Superficial muscular layer incised and turned back. 5. Flexiform fasciculæ of the middle layer. 6, Elliptical openings occupied by the uterine sinuses.—(*Henle.*)

thelium, alone separates the fetal from the maternal blood in the intervillous spaces. The *uterine artery* is much enlarged during pregnancy, but relatively less so than the ovarian. As pregnancy advances it becomes more tortuous,

its course being less direct, and its attachment to the uterine wall loosened.* Its level in the pelvis will depend on the upward growth of the uterus, as well as on its attachment to the pelvic wall, and its relation to the outer border of the broad ligament is lost in the latter part of pregnancy. Its relation to the ureter is the same in pregnant and non-pregnant uteri (Fig. 156). The *ovarian artery* is greatly enlarged in pregnancy. Its course from the point where it reaches the pelvic brim at the bifurcation of the common iliac artery is upward and forward, accompanying the infundibulo-pelvic ligament, lying close to the

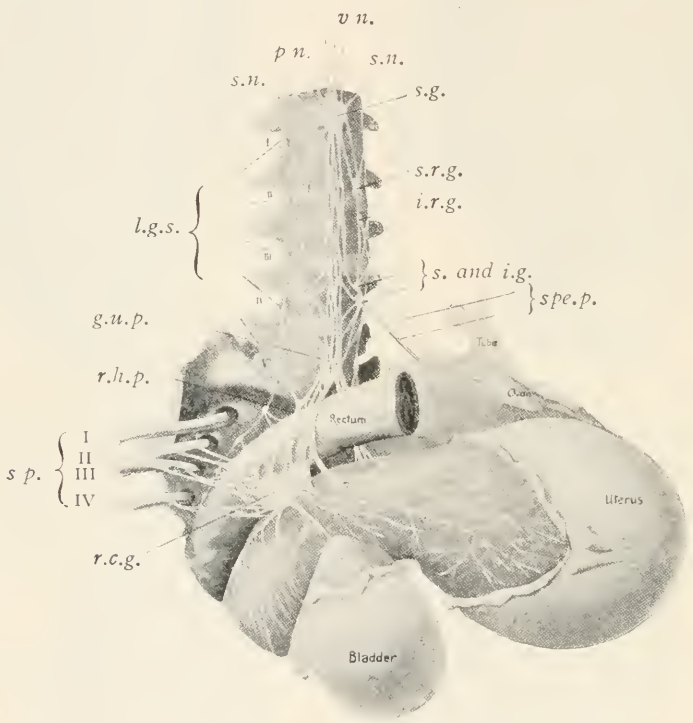

Fig. 155.—Nerve-Supply of the Female Genital Organs. *p.n.*, Phrenic nerve; *s.n.*, splanchnic nerve; *l.g.s.*, lumbar ganglion of the sympathetic; *g.u.p.*, great uterine plexus; *r.p.h.*, right hypogastric plexus; *s.p.*, sacral plexus; *r.c.g.*, right cervical ganglion; *v.n.*, vagus nerve; *s.n.*, splanchnic nerve; *s.g.*, solar ganglion; *s.r.g.*, suprarenal ganglion; *i.r.g.*, infrarenal ganglion; *s. and i.g.*, superior and inferior genital ganglia; *spe.p.*, spermatic plexus (ovarian nerves).—(*Frankenhäuser.*)

ovary, overshadowing the Fallopian tubes, and finally reaching the cornu of the uterus (Polk) (Figs. 156 and 157).

10. Nerves.—The logical view seems to be that these organs of sensation participate in the general increase of the other parts of the uterus.

11. Lymphatics.—The lymphatics increase greatly, both by hypertrophy and hyperplasia. The lymph spaces just below the mucous membrane are much increased in size, and the lymph channels which run from them through the muscles of the uterus reach the size of a goose-quill. Underneath the peritoneum these lymph vessels form a plexus continuous with the general lymphatic system. On this arrangement of these absorbent vessels depends that striking

* Tandler und Halban: "Topographie d. weibl. Uterus," 1901.

characteristic of the uterus after labor, its readiness to take up and assimilate infecting material, peritonitis frequently presenting the first symptom of this process.

12. Peritoneum.—The connective tissue found in the uterus between its peritoneal covering and the muscular walls becomes less dense and more cellular, so that while the peritoneum in the non-gravid state was closely bound to the organ, allowing very little if any motion between the two, in the pregnant condition, especially at term, it is freely movable on the muscular coat, thus diminishing the risk of laceration during labor. The peritoneum at the end

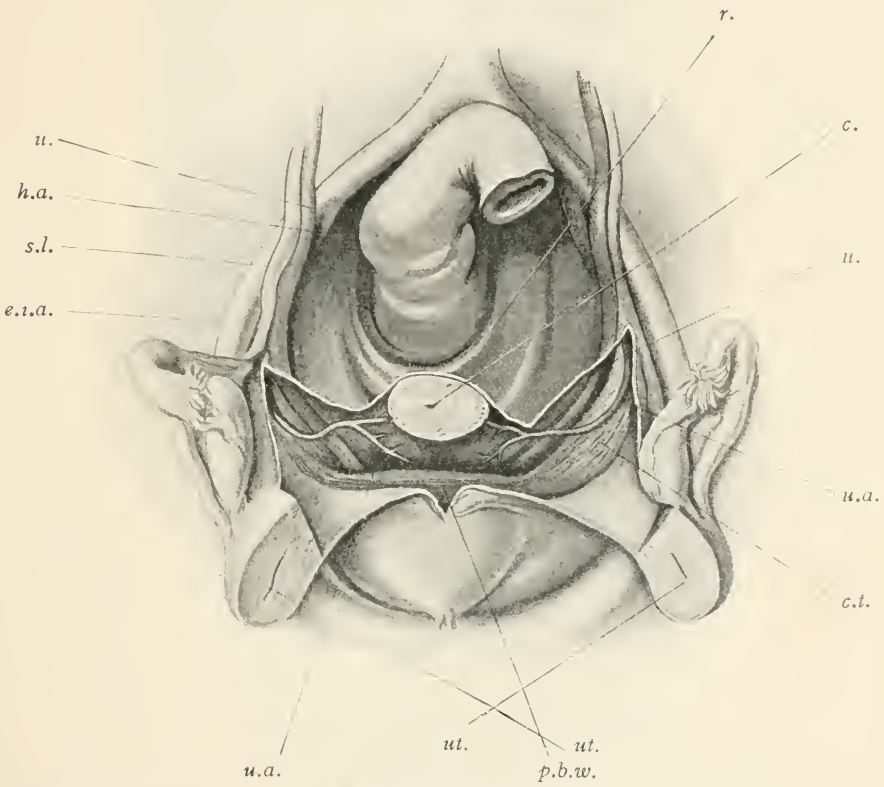

Fig. 156.—Relations of the Ureters, Uterine Arteries, and Cervix in the Non-pregnant State. *u.*, *u.*, Ureter; *h.a.*, hypogastric artery; *s.l.*, suspensory ligament; *e.i.a.*, external iliac artery; *u.a.*, uterine artery; *p.b.w.*, posterior bladder wall; *r.*, retro-uterine fold; *c.*, cervical canal; *u.a.*, uterine artery; *c.t.*, cellular tissue; *ut.*, uterus. —(*Tandler and Halban.*)

of pregnancy, before the sinking of the uterus, shows a shallowing of the anterior fossa, and the pouch of Douglas is almost obliterated. The retro-ovarian shelves are now on a level with the pelvic brim, instead of on a level with a line drawn from the middle of the symphysis to the third or fourth piece of the sacrum. The pouch of Douglas is raised. There is backward displacement of the broad ligaments, from the growth of the uterus, causing the almost complete obliteration of the posterior fossa. (*a*) *Broad ligaments:* During pregnancy the broad ligaments are drawn upward, so that at full term the bases of the ligaments lie on a level with the pelvic brim, and extend from the pectineal eminence ante-

riorly, to the synchondrosis posteriorly, these limits being determined by the round ligaments anteriorly and the ovarian artery posteriorly. Separation of the laminæ of the broad ligaments during pregnancy causes the triangular form at

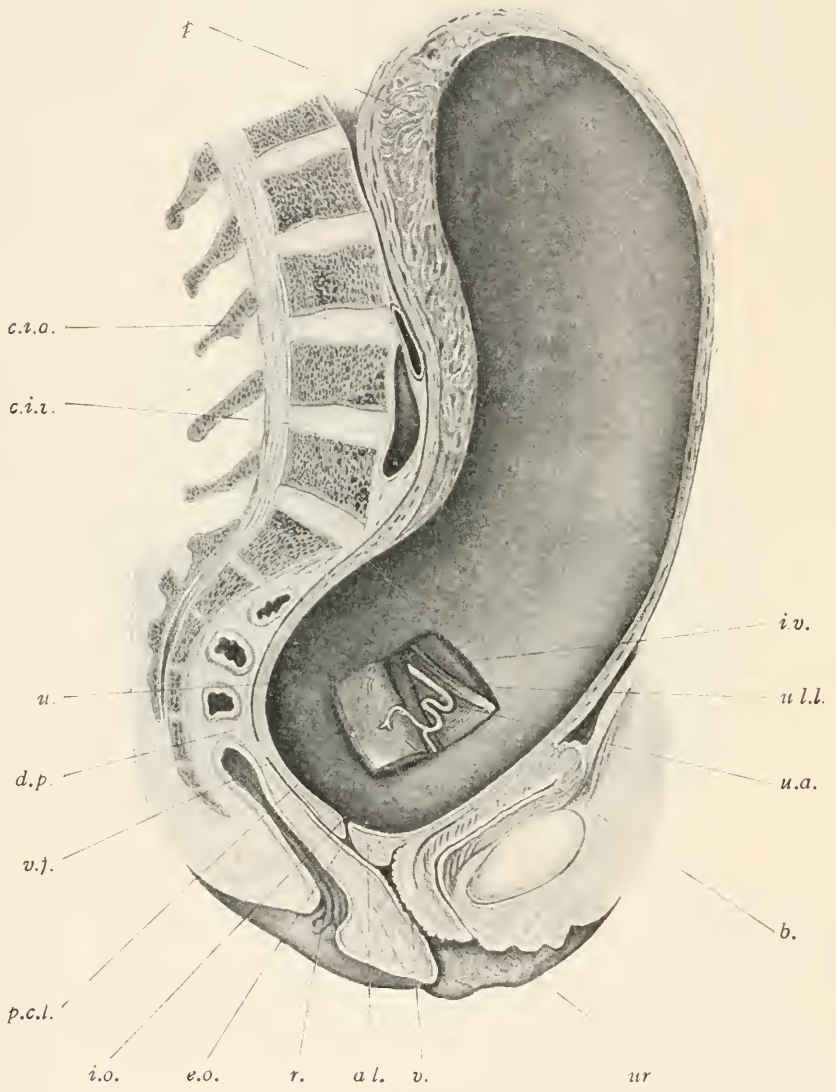

FIG. 157.—TOPOGRAPHY OF THE UTERINE ARTERY AND URETERS IN PREGNANCY AT THIRTY-SIXTH WEEK. *p.*, Placenta; *c.i.a.*, common iliac artery; *c.i.v.*, common iliac vein; *u.*, ureter; *d.p.*, Douglas' pouch; *v.f.*, vaginal fornix; *p.c.l.*, posterior cervical lip; *i.o.*, internal os; *e.o.*, external os; *r.*, rectum; *a.l.*, anterior lip; *v.*, vagina; *i.v.*, internal iliac vein; *u.l.l.*, umbilical lateral ligament; *u.a.*, uterine artery; *b.*, bladder; *ur.*, urethra.—(*Tandler and Halban.*)

full term, the base of the triangle corresponding to the pectineal line, and its apex to the horn of the uterus (Fig. 159). After delivery the ligaments slowly regain their position in the pelvis. Hence the ureters have no fixed relation to the broad ligaments in the latter part of pregnancy, because the ureters do

not undergo the same displacement during gestation. (*b*) The *utero-sacral ligaments* are attached, in the latter part of pregnancy, to the first, instead of to the third or fourth, sacral vertebra. (*c*) The round ligaments by the growth of the uterus are drawn up above the pelvic outlet.

13. PROPERTIES.—(*a*) *Sensibility:* The sensibility of the uterus undergoes very little change. The cervix in the non-pregnant state may sometimes even be cauterized without much discomfort to the patient. But the sensibility varies

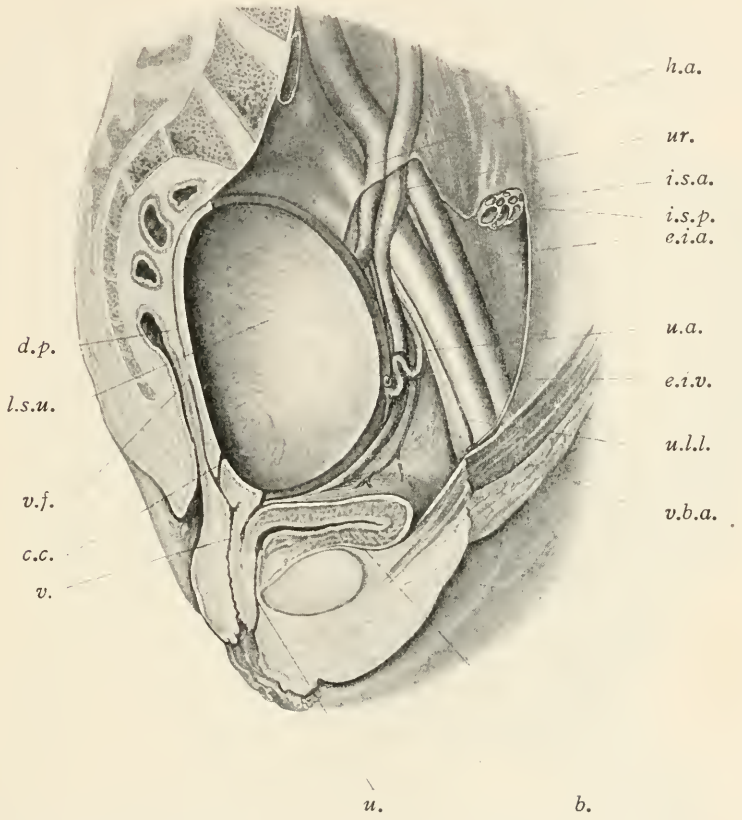

FIG. 158.—TOPOGRAPHY OF THE UTERINE ARTERY AND URETERS IN PREGNANCY AT THE THIRTY-SIXTH WEEK.—Same as Fig. 157 with upper portion of left uterine wall and a portion of the peritoneum removed. *d.p.*, Douglas' pouch; *l.s.u.*, lower segment of uterus; *v.f.*, vaginal fornix; *c.c.*, cervical canal; *v.*, vagina; *h.a.*, hypogastric artery; *ur.*, ureter; *i.s.a.*, internal spermatic artery; *i.s.p.*, internal spermatic plexus; *e.i.a.*, external iliac artery; *u.a.*, uterine artery; *e.i.v.*, external iliac vein; *u.l.l.*, umbilical lateral ligament; *v.b.a.*, vesical branch of uterine artery; *b.*, bladder; *u.*, urethra.—(*Tandler and Halban.*)

in accordance with its cause; *e. g.*, forced dilatation of the cervix is quite painful. The body, although somewhat less sensitive than the cervix, is not entirely insensible, for pain is caused by the contractions of labor, or by the introduction of a sound or hand. Even fetal movements are painful to some women. (*b*) *Irritability:* This property also differs in various subjects. Irritability of the uterus, when excessive, is probably of pathological origin The slightest cause in some women—a misstep, for example—may cause abortion; while others may ride to hounds with no injurious results. (*c*) *Contractility:* The muscle-fibers exhibit

contractility, which consists in a shortening of the fibers followed by relaxation. Contractions occur throughout pregnancy, and are usually painless; they promote the uterine circulation and help to fix the position of the child.

14. Thickness of the Walls.—The great increase in the size of the uterine cavity is not due to the mechanical pressure of the growing ovum, but to the hypertrophy of the walls themselves. If the former cause obtained, the pregnant uterine walls would be much thinner than those in the non-gravid state. In the first three months the walls increase a little in thickness, owing to the rapid development of the muscular and vascular systems; at the fifth month they are about normal in thickness (Fig. 133), and at term they are of a thickness about equal to that of the non-pregnant parietes, although a trifle thicker at the placental site; and much thinner in the lower uterine segment, the thickness thus varying at different points (Fig. 137).

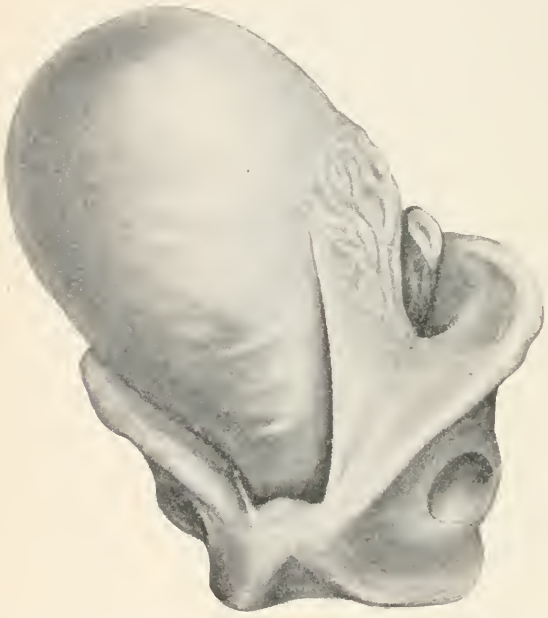

Fig. 159.—Broad Ligaments of the Pregnant State. Pregnant uterus at the thirty-sixth week. —(*Polk.*)

15. Topographical Relations at Term (Fig. 160).—The topographical relations of the intestines are worthy of note. They are always above, behind, and at the sides of the uterus, thus giving no resonance over the anterior abdominal wall. In front of the uterus are the vagina, the posterior surface of the bladder, and the internal surface of the anterior abdominal wall. Now and then, as an exception to the statement previously made, one or more coils of intestine intervene between the uterus and the abdominal wall. Behind, the uterus is in relation with the rectum, the sacro-vertebral articulation, the vertebral column, the mesentery, and a mass of intestines; on the right, with the corresponding side of the pelvic excavation, the iliac vessels, the psoas muscle, cæcum, and right abdominal wall; on the left, with the corresponding part of the pelvis, the iliac vessels, the aorta, the sigmoid flexure, the psoas muscle, and a mass of intestines which separate the uterus from the left lateral abdominal wall. The fundus is in relation with the transverse colon, a part of the stomach, the anterior margin of the liver, the ensiform cartilage for a time, and the lower floating ribs. The ovaries and Fallopian tubes are close to the sides of the uterus, at a point corresponding to the junction of the upper and middle segments. When pregnancy is drawing to a close, a large part of the anterior uterine surface is in contact with the abdominal wall, while its lower surface rests against the posterior part of the symphysis pubis. The posterior surface leans against the spinal column; the large intestines cover the fundus, while the small intestines are forced to both sides.

5. **Bladder.**—In early pregnancy the bladder is not so capable of expanding

in an antero-posterior direction, and so the distention takes place laterally. In the displacements of the uterus, which are so frequently seen in pregnancy, the bladder follows the uterus. As the uterus ascends in its growth,

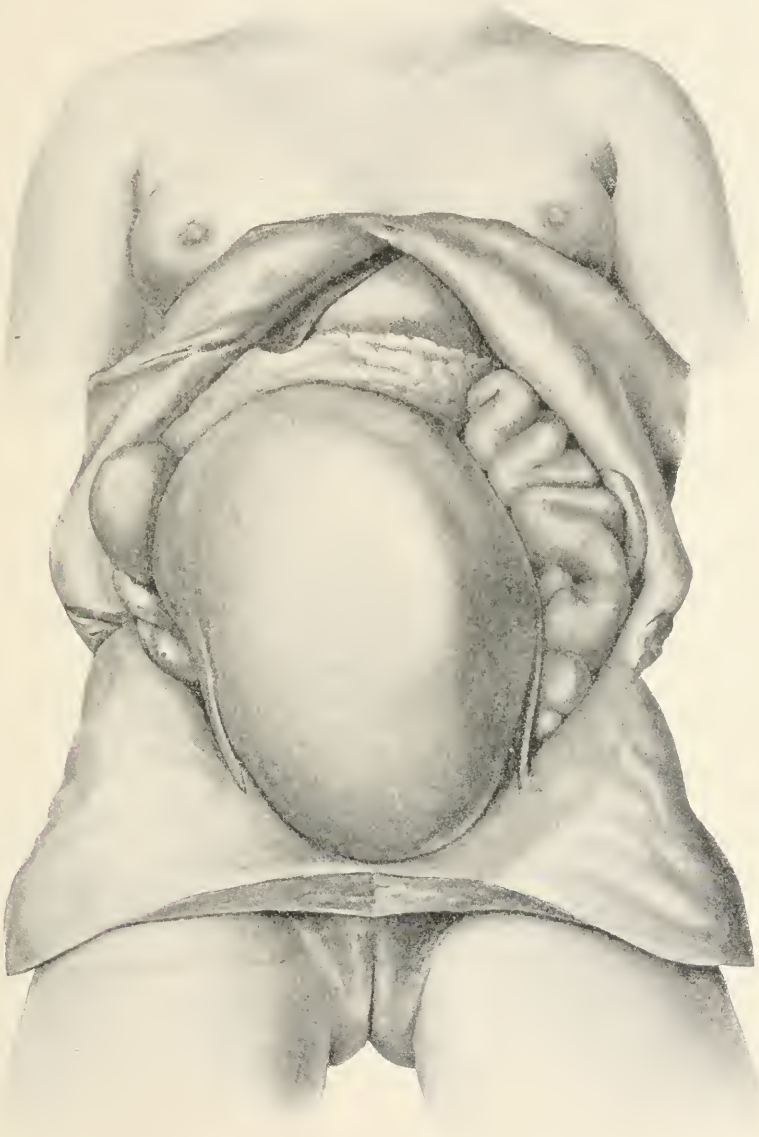

FIG. 160.—TOPOGRAPHY OF THE UTERUS AT THE FORTIETH WEEK. Right lateral obliquity and axial torsion from left to right of the uterus are present.—(*From nature.*)

therefore, the urethra elongates, and in certain uterine displacements may become partially or completely occluded, thus leading to overdistention of the bladder, paralysis of its musculature, decomposition of the retained urine, and

cystitis. If the uterine displacement is not corrected, there may result disastrous vesical troubles, the lining membrane may be cast off in shreds, or a cast may be thrown off; even the muscle-layer may contribute to the general disturbance. As the bladder accompanies the uterus in its upward growth, the orifice or bulb of the urethra is elevated and hidden behind the symphysis pubis, and it is consequently more difficult to introduce a catheter. The canal also becomes more curved, so that a curved male catheter is used with more facility than the straight female instrument. The dragging upon the bladder by the initial prolapse of the uterus, together with the subsequent (third month) pressure of the latter when anteverted, diminish the size of the bladder, causing frequency of micturition. At times, when the bladder is full, a simple sneeze or cough will cause involuntary discharge of urine. Vesical tenesmus may also annoy the patient, particularly during the first three months, before the uterus rises; and also during the last fortnight of pregnancy, after it has fallen.

6. Ureters.—In the latter part of pregnancy the ureters do not, as in the non-pregnant state, follow the pelvic wall to the ischial spines; but, having crossed the brim near the bifurcation of the common iliac artery, they accompany the internal iliac artery. They leave the pelvic wall about on a level with the brim, pass beneath the broad ligament on the same level, and downward, forward, and somewhat inward, about midway between the pelvic wall and the utero-vaginal junction; and approach closely the anterior wall of the vagina, entering the base of the bladder about one inch below the cervix, and about two inches below the spine of the pubis (Polk) (Tandler and Halban) (Figs. 156, 157, and 158).

7. Rectum.—The rectum is apt to be loaded during pregnancy. This constipation is not so much due to the local uterine pressure, as to diminished peristalsis of the intestinal tract. During the early part and the last two weeks of gestation, constipation may alternate with diarrhea, from the irritation caused by the descent of the uterus. From interference with the blood-supply, hemorrhoids may develop in the anus and rectum.

8. Lower Extremities.—In the later months of pregnancy, œdema and varicose venous enlargements are often found, due to the obstruction to the return circulation (Part III). Numbness, neuralgia, pains, cramps, and difficulty in walking may all result from the pressure of the uterus upon the sacral plexus.

9. Pelvic Joints.—The inter-articular cartilages, especially that of the symphysis, become softened and hyperemic, and more movable. The pelvic ligaments also participate in the swelling and softening, and the synovial membranes are increased in size and said to be distended with fluid. Thus the component parts of the joints are pushed apart. Occasionally a case is so extreme that it is some time before the normal power of walking returns. The movement of the coccyx on the sacrum is important. This permits a bending back of the coccyx during labor, thus lending an efficient aid to the process, for the antero-posterior diameter of the pelvic outlet is materially increased (see Physiological Labor).

10. Breasts.—Intimate sympathetic relations exist at all times between the breasts and the pelvic organs. Very early in pregnancy, usually about the second month, the mammæ increase in *size* and become tender. This growth continues during pregnancy, and consists in the increase of connective and glandular tissues and fat. Blue *veins* become prominent and course over the breasts. Permanent *striæ* appear at any time after the sixth month, due to stretching of the cutis vera, which permits the subcutaneous fibrous tissue to glisten through (Fig. 161). The *nipples* also enlarge and become sensitive.

Their power of erectility is also increased. They are often covered with small branny scales. The *areolæ* become much enlarged, and darker in color from a deposit of pigment. This varies in degree with the complexion of the patient. In blondes it is sometimes scarcely perceptible, while in brunettes a great part of the breast may be involved. The areola, in addition to becoming dark, grows moist and swollen, while the series of tubercles increase in size in it around the nipple. Montgomery believes them to be closely connected with the lactiferous ducts, which can sometimes be traced to their summits where they open. These also increase in size and number with the progress of pregnancy. Outside the primary areola, in the later months of pregnancy, a secondary circle appears, called the *secondary areola*. This is composed of light spots scattered all around the periphery of the areola, which has shaded off from the deeper tones near the center. This change, too, is more marked in brunettes. Even as early as the third month, pressure on the breasts may force out a drop of serous-looking liquid. On microscopic examination milk and colostrum globules will be detected, the latter being desquamated epithelial cells of the glands filled with oil-globules (Fig. 6).

GENERAL PHENOMENA.

1. Digestive System.—*Nausea and vomiting* are common disturbances in pregnancy. They are of all grades, from one simple attack at the time the woman first raises her head from the pillow, to repeated and severe vomiting spells, which occur from time to time during the day, and even in the night. These attacks sometimes begin with conception; more commonly, however, about the sixth week, lasting, as a rule, until the fourth month. The assumption of the erect position seems to cause this nausea, probably on account of the extra congestion brought on in the uterus by this position, thus increasing its irritability. These symptoms may result from various conditions of the stomach or uterus, though the common and probably correct explanation of the milder variety is that the uterine fibers are stretched, and the nerves consequently irritated. (See Toxemia of Pregnancy.) Gastric indigestion may also occur, causing acidity, flatulence, heartburn, eructations, etc. The intestines seem to lack their normal peristaltic power, and that, together with the pressure of the growing uterus, renders *constipation* a common ailment of pregnancy, and one which should be relieved in order to prevent overburdening the kidneys. Diarrhea and excessive flatulence are at times not uncommon. The former may be of nervous origin, due to the mechanical irritation of the intestines by the growing uterus. Intestinal indigestion is also very common, and may give rise to severe cramps. The *appetite* is apt to be capricious in early pregnancy, though it may change and become ravenous. There may be curious morbid cravings for various substances, such as clay, chalk, slate-pencils, certain vegetable acids, etc.; even disgusting articles may come into the category.

2. Heart.—The existence of hypertrophy of the left ventricle has usually been taught as a physiological change in pregnancy to meet the extra demands made on the organism by the complex vascular arrangement of the pregnant uterus. The right ventricle and the two auricles were not believed to participate in this hypertrophy. Alfred Stengel and W. B. Stanton, of Philadelphia, however, controvert the old French notion that the heart becomes hypertrophied during pregnancy. By a series of carefully made tracings and readings of instruments devised for the measurement of blood-pressure, they show the correctness

of Gerhardt's idea that the growth of the fetus, by pressing up the diaphragm, forces the apex of the heart upward and outward, and that this dislocation has been misinterpreted as a sign of hypertrophy. The tracings in twenty-six cases with careful measurements show this dislocation, which disappears after parturition. There is, however, a slight irregularity in the contour of the upper right margin of the heart, indicative of a slight hypertrophy of the right conus arteriosus. The murmurs which are heard in primigravidæ are probably the result of a slight overaction of the right heart. No constant changes in blood-pressure could be demonstrated.

3. Lungs.—The mother has to provide for the nourishment of her child and herself during pregnancy, therefore an extra quantity of blood must not only be circulated but purified. In this process the elimination of carbonic acid gas must be increased. By mechanical pressure of the growing uterus the diaphragm is forced upward, lessening the longitudinal diameter of the respiratory space, although the lower thorax is somewhat broadened. This decrease in breathing space causes a certain amount of dyspnea, from the time of the beginning till the last weeks of pregnancy, when the uterus sinks again, and respiration and circulation are carried on with greater ease. In the early months cough and dyspnea, from sympathy, may cause a derangement of the respiratory organs, while the same is later caused by the growing uterus. These phenomena are most common in twin pregnancies, or in dropsy of the amnion.

4. Liver.—Tiny fatty globules occur in the cells of this organ, varying in size from a pin's head to a millet-seed. De Sinety believes this change to be particularly associated with lactation, and to disappear after that period. The liver is also enlarged, as are the *spleen* and *lymphatic glands*, both the latter showing the same fatty changes. The enlargement of the spleen is due to the important relation existing between it and the quantitative change in the circulating blood. (See Toxemia of Pregnancy.)

5. Nervous System.—The changes are purely *functional*, and disappear quickly after delivery. The nervous system becomes more impressionable. The changes in the special senses are chiefly characterized by increased excitability. The list of reflex nervous phenomena is manifold, and they are even seen, in a relatively slight degree, in young women at the time of ovulation and the beginning of menstruation. Much more will they be excited by the great changes taking place in the maternal organism in pregnancy.

Psychical Changes.—The disposition is in some cases entirely altered for the time being. Women previously amiable become peevish, fretful, irritable, and overanxious about their health and the condition of the offspring; and look forward with great dread to the pangs of labor. Others are affected in the opposite way, and become buoyant in spirits and unusually cheerful. This difference seems to depend largely on the intensity of the desire on the part of the mother for a child. The state of despondency which is so common, especially in the first part of pregnancy, may lead to extreme melancholia and even develop into mania or dementia. This condition is seen particularly in patients of an intensely neurotic organization, in those with an hereditary taint of insanity, or with a history of hysteria or alcoholism. It may also follow severe mental shock in pregnancy. Unhappy marriages are also a fruitful cause of mania in gestation. Hysteria in pregnancy offers an excellent illustration of the fact that the gravid state accentuates any defect, either physical or mental, in the patient. It was formerly thought that pregnancy exerted a beneficial effect on a hysterical woman, but this is erroneous. However, after its occurrence the patient should be carefully watched and guarded. The physician

should encourage her, and as is the case with the insane, special attention should be paid to the nutrition of the sufferer, and if necessary forced feeding should be instituted. Again, the patient should be treated with perfect frankness, and no deceit attempted. A careful physical examination before labor often gives the patient a feeling of confidence in her adviser.

6. Blood.—Many conflicting views concerning the blood changes in pregnancy have existed. The whole quantity is increased. It is generally agreed that there is a slight leucocytosis, but as to the increase or decrease in the number of red blood-corpuscles, there is still a dispute. Many authors believe their proportion to be decreased, but Ahlfeld, quoting the work of Reinl, Schröder, Ingerslev, Fehling, Mayer, Wild, Mochnatscheff, and Frommel, declares that they are increased, as is the liquid element of the blood. The number of white corpuscles, as has been indicated, are also slightly increased. The blood is deficient in albumin, but increased decidedly as to its fibrin element, as well as extractive matters. This fact explains the frequency of thrombotic affections in connection with pregnancy and delivery. This hyperinosis is increased also after labor, by the great quantity of effete matter thrown out into the circulation of the mother, to be disposed of by her emunctories. The blood of the pregnant woman is generally in a state more like that in anemia than plethora, and treatment should be applied accordingly. Objections to the anemia theory have been raised, on the ground that pregnancy is a physiological, and not a pathological condition. This is ideally true, but owing to the influence of many factors, such as civilization, climate, diet, and others, it must be admitted that the pregnant woman is seldom in a state of perfect health; that her condition leans toward anemia and poverty of blood, and must be considered and treated accordingly.

7. Urine.—As to the frequency of albuminuria in pregnancy, authorities differ, as well as to the amount of albumin commonly present; some declaring the percentage to reach 20 or 30. In physiological albuminuria there are no tube casts, nor any morbid symptoms. Albuminuria is far more common in labor than in pregnancy, and its existence is explained by the theory of renal anemia caused by the reflex vasomotor spasm of the renal arteries, resulting from the uterine contractions. It may occur early, before there is any possibility of renal venous stagnation from pressure, and it is then the result purely of reflex irritation. The intimate relation between the nerve ganglia of the pelvis and the venous supply of the kidney would explain this. The urine exhibits both quantitative and qualitative changes. The amount excreted in twenty-four hours is increased in quantity and decreased in specific gravity, due to the hydremic condition and the high arterial tension. There is an increase in the chlorides, and the phosphates and sulphates are decreased, on account of their use in the development of the fetus. Chalvet and Barlemont found a decrease also in the urea, uric acid, creatin, and creatinin; these may also pass over to the fetus (Lehmann and Donne). (For Albuminuria and Pregnancy-kidney see Part III.)

8. Skin.—The functions of the glands of the skin—sebaceous, sweat, and hair follicles—are increased in gestation. Pigmentary spots over the body are common. Patches of yellowish-brown color over the face are known as chloasma or the "mask of pregnancy." The abdomen and breasts are also darkly pigmented in areas. The lineæ albicantiæ are very marked. Many women will have on the abdomen a brown area of about two fingers' breadth, extending from the mons veneris to the umbilicus, which it sometimes surrounds, and beyond to the xiphoid cartilage. This band is more distinct below than above

the navel (Fig. 161). The circle around the latter is known as the "umbilical areola" (Fig. 161). The mammary areolæ, both primary and secondary, have been described. These pigmentations undergo many variations in extent and degree in different patients. Brunettes show them more plainly than blondes. The pigmentation of the vulva, as a sign of early pregnancy, has also been referred to. These deposits seldom disappear entirely, but they are less after labor. Abdominal striæ, or silvery streaks or white lines, are seen on the abdominal wall as the result of the first pregnancy; and it is not uncommon to observe the formation of new ones in subsequent pregnancies (Fig. 161). They may also be seen on the hips, thighs, and breasts (Fig. 161). These markings are at first of a pinkish or bluish-red tint, but after parturition they become white or pearl-colored. They are due to the partial rupture and atrophy of the connective tissue of the deep layers of the distended skin. They are not peculiar to pregnancy, but occur even on men after the skin has been subjected to much stretching, as in ascites, etc. The skin covering the umbilical depression, in the first three months of intrauterine gestation, is drawn inward and downward, by the traction on the urachus, the ligament following the descent of the bladder occasioned by the early sinking of the uterus. The navel now presents a pit or depression. This causes a dragging sensation; when the uterus begins to rise out of the pelvis, the navel resumes its former appearance. During the fourth, fifth, and sixth months the depression becomes progressively shallower, till at the seventh it is on a level with the skin, the ring being at the same time dilated so as to admit the end of the finger. During the last two months the umbilicus may actually form a protuberance, and this condition is known as "pouting of the navel." Not infrequently, if the woman overexert herself, an umbilical hernia will be formed.

FIG. 161.—PREGNANCY AT THE THIRTY-EIGHTH WEEK SHOWING STRIÆ AND PIGMENTATION OF THIGHS, ABDOMEN, AND BREASTS, AND RIGHT LATERAL OBLIQUITY OF THE UTERUS.—(*From author's photograph at the Emergency Hospital.*)

9. Gait.—The gait of a pregnant woman undergoes change, for in order to preserve the center of gravity, the head and shoulders must be thrown backward. Short women show this change most markedly.

10. Delay of Bony Repair.—On account of the drain by the fetus on the mother's osseous elements, fractured bones unite slowly.

11. Temperature.—The temperature in pregnancy remains unchanged. Some authorities, however, believe it to be lower in the morning than later in the day.

III. THE DIAGNOSIS OF PREGNANCY.

Importance.—The importance of expert diagnosis in cases of suspected pregnancy is very apparent. There are no mistakes in a physician's experience so hard to live down as those made in this department of medicine, and none that excite harsher criticism, or greater ridicule for the diagnostician. Apart from these less important considerations, it must be remembered that the knowledge of the existence of pregnancy is often of the greatest importance to the life of the patient, both in the field of medicine and that of surgery. A physician can sometimes render incalculable service by being able skilfully and honestly to exclude the possibility of pregnancy; and, on the contrary, he can do great harm

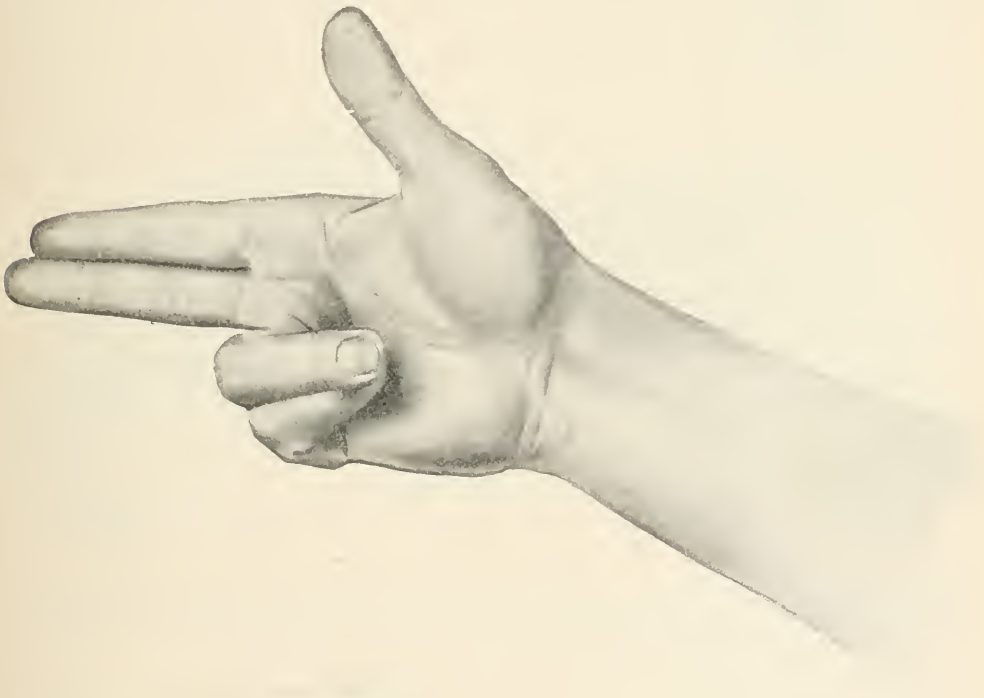

FIG. 162.—POSITION OF THE FINGERS FOR VAGINAL EXAMINATIONS AND MANIPULATIONS. —(*Photograph.*)

and cause much misery by expressing the opposite opinion in a case innocent of this condition, the opinion being based on a careless or ignorant interpretation of the signs presented. The medico-legal value attaching to this question is often important.

A number of symptoms and signs taken together give certain evidence of the presence of pregnancy; and single signs, especially in the latter part of pregnancy, render the diagnosis probable or even positive. The physician, however, will always do well to be reserved in the expression of his opinion, if there is any doubt as to the condition. The diagnosis depends upon the physician's ability to group the symptoms in the order of their importance, and upon his familiarity with all the methods of examination. The difficulties of diagnosis

will be considered later, under the head of differential diagnosis. Mistakes should be avoided by the greatest care in the details of the examination. With all these precautions, there are on record numerous cases which exemplify the striking errors of eminent specialists.

The physical signs are of far more importance and value than the symptoms, and are obtained by means of sight, touch, and hearing. There is much room for deception in the patient's account of herself, for she may intentionally or unintentionally misrepresent one or all of her symptoms. But the information which is obtained by inspection, palpation, percussion, and auscultation, lacks the uncertain element always present in the personal history, and gives data that can be relied upon. Upon the period of the pregnancy will depend to a certain extent the satisfactory results of the examination. For the preparation and posture of the patient for the examination see Obstetric Examination.

Classification.—The symptoms and physical signs of pregnancy may be

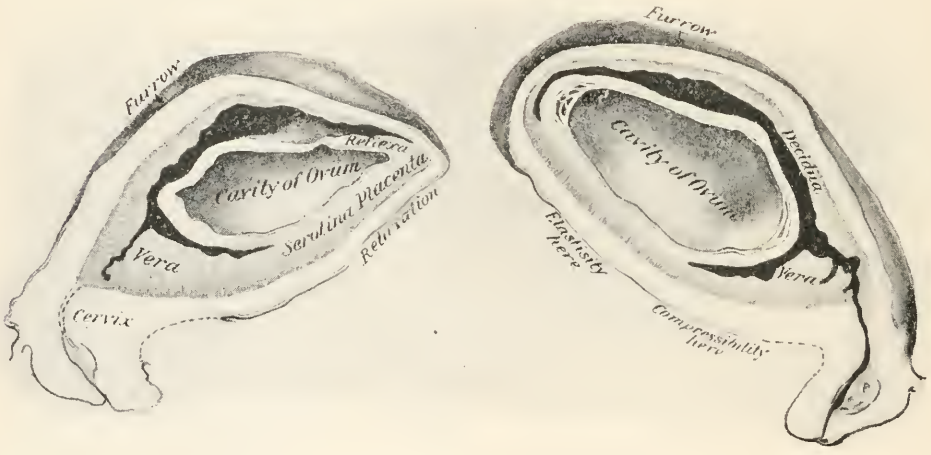

FIG. 163.—RIGHT AND LEFT HALVES OF A FROZEN SECTION OF A UTERUS AT TWO AND A HALF MONTHS, SHOWING CHANGES IN SHAPE AND DENSITY OF THE UTERINE WALLS AND THICK DECIDUA.—(*After Pinard.*)

conveniently classified as: (1) Uterine; (2) vaginal; (3) abdominal; (4) mammary; (5) fetal; (6) sympathetic and reflex; (7) due to pressure and congestion; (8) cutaneous; (9) individual and subjective.

1. Uterine.—(1) CESSATION OF MENSTRUATION.—This, as a general rule, is the first warning of pregnancy to women who have been exposed to impregnation. It is not a perfectly trustworthy symptom, for it may occur in various diseases and conditions. However, when occurring in healthy women who have previously menstruated regularly, it is strongly presumptive of pregnancy, and it is of great practical value, as it probably offers the most reliable datum for predicting the date of confinement. Nevertheless, certain errors must be guarded against in relation to this symptom, for various chronic diseases, such as tuberculosis, anemia, syphilis, and some acute affections, such as diphtheria, pneumonia, and dysentery, may cause a cessation of the menstrual flow, either permanently or temporarily. Change of climate; exposure to cold; mental emotions; general debility; excessive desire to become pregnant, as in the newly

married; or a fear of becoming so in the unmarried who have exposed themselves to impregnation—all these causes may be instrumental in bringing about a cessation of the menses. Pregnancy may occur in cases in which menstruation is absent, as in women during lactation; while it has been known to occur in young girls before this function was established. A few authentic cases are recorded of the occurrence of conception after the climacteric; and, again, of the continuance of the menstrual periods during pregnancy, or of what is thought to be menstruation by the patient. At the same time there may be hemorrhages due to pathological conditions of the internal genital tract, as from the vagina, mucous membrane of the cervix, decidua, chorion, polypi, or placenta prævia. If menstruation pure and simple does occur during pregnancy, it may easily be explained by the anatomical condition of the growing uterus with its contents. (See Development of the Ovum, page 46.)

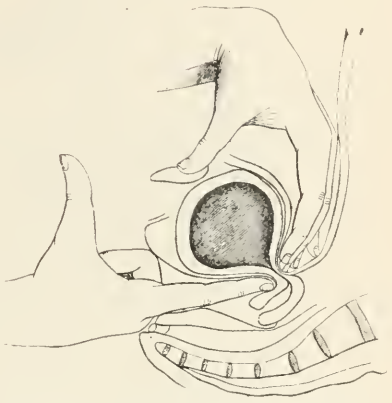

Fig. 164.—First Method of Eliciting Hegar's Sign of Pregnancy.—(*Sonntag.*)

(2) Changes in Volume, Shape, and Position.—In palpating the uterus in search of the signs of pregnancy, the bimanual or conjoined method is preferable to simple palpation with one hand, or vaginal touch, as it is called; and of the bimanual methods, the abdomino-vaginal is most useful, and most often used, but the abdomino-rectal is occasionally of value, especially in primigravidæ. The physical signs arising from the progressive growth of the uterus, causing alterations in volume, shape, and position

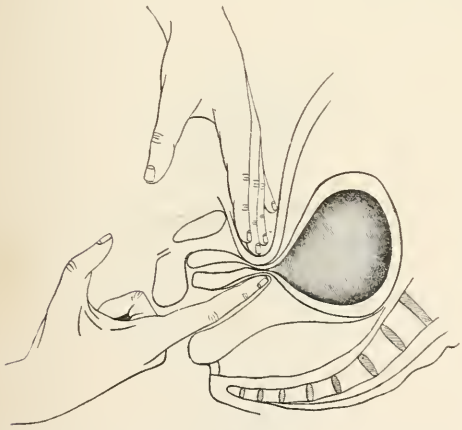

Fig. 165.—Second Method of Eliciting Hegar's Sign of Pregnancy.—(*Sonntag.*)

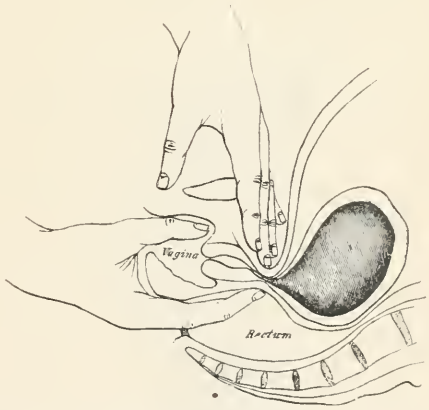

Fig. 166.—Third Method of Eliciting Hegar's Sign of Pregnancy.—(*Sonntag.*)

of the organ, have already been described under "The Local Changes Produced by Pregnancy," page 91, and familiarity with these changes should be acquired by the student. At the same time, other causes of uterine enlargement may simulate pregnancy, as subinvolution, inflammation of the uterus and peri-uterine

FIG. 167.—POSITION OF THE TWO HANDS IN THE BIMANUAL EXAMINATION FOR THE DIAGNOSIS OF PREGNANCY.

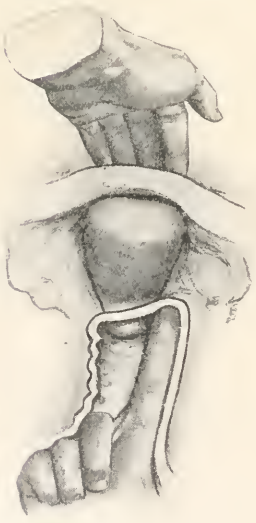

FIG. 168.—BIMANUAL EXAMINATION WITH THE HAND ON THE FUNDUS AND ONE FINGER IN THE LEFT LATERAL VAGINAL FORNIX.

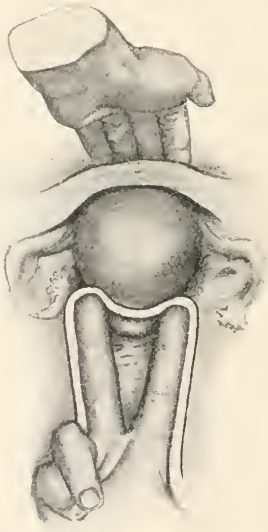

FIG. 169.—BIMANUAL EXAMINATION WITH THE HAND ON THE FUNDUS AND A FINGER IN EACH VAGINAL FORNIX.

tissues, and intramural tumors of the organ. (See Differential Diagnosis of Pregnancy.)

(3) Changes in Consistency.—(*a*) *Progressive softening of the cervix*, which begins at the external os, and gradually extends, until by the end of pregnancy the whole cervix is included in a velvety softness due to serous infiltration. Beginning softening can often be detected as early as the second or third week; on this change Goodell founded the rule that, when the cervix is as hard as the tip of one's nose, pregnancy presumably does not exist; but if it be as soft as one's lips, pregnancy is probable. (*b*) *Softening and compressibility of the lower uterine third constitute Hegar's sign.* This is of great value, and has been observed by the sixth or eighth week. It consists in alteration in the consistency and shape of the region of the uterus situated just above the cervix—a change that is most striking in the middle division of the lower uterine third. This part of the uterus seems at times hardly thicker than ordinary cardboard, and it would appear almost as if the fundus and the cervix were separate tumors. The shape is also changed, the lower uterine third widening abruptly above the cervix, and not gradually, as in the normal pear-shaped uterus. These alterations are far more difficult to recognize in women who have already borne one or more children, but when well marked are absolutely indicative of a pregnant uterus. The detection of these changes requires a certain degree of skill in the performance of the bimanual examination, and also of familiarity with the sensations communicated to the finger by the non-pregnant uterus of women who have never borne children, by the non-pregnant uterus of women who have borne several children, and also by the uterus altered by certain pathological conditions. *Method of examination:* (a) In a patient whose abdominal walls are lax and thin and whose vagina is roomy, the two fingers are introduced into the vagina, and passed high up behind the cervix, while the other hand presses down into the abdomen from above and behind the pubes (Fig. 167). (b) But if the fundus should be decidedly anteflexed, the vaginal finger should be passed up in front of the cervix, while the external hand presses down the fundus (Fig. 167). (c) Where the favorable conditions of lax abdominal parietes and capacious vagina are not present, the index-finger is passed into the rectum, while the thumb is inserted into the vagina in front of the cervix. The other hand, in the meanwhile, exerts pressure on the abdomen behind the pubes. (d) Still another method is feasible: with the internal hand in the same position as in the last method, the external hand presses the fundus uteri downward. Sometimes the cervix is pulled down by a tenaculum. Between the second and fifth months of pregnancy 30 per cent. of the cases may be recognized by this sign. Anesthesia is rarely required in order to conduct these examinations. There are diseased conditions of the wall of the uterus in which this sign cannot be obtained, even though pregnancy exists. (*c*) *Consistency of body of uterus.* Pregnancy changes the rigid, firm, inelastic condition of the non-pregnant uterus, to an elastic, resilient state which increases with the advance of pregnancy, until the fetus is contained in a flexible, elastic-walled cavity. The peculiar sensation imparted by a uterus enlarging from pregnancy is most characteristic (Fig. 163). (See Local Changes Produced by Pregnancy.)

(4) Intermittent Contractions—Braxton Hicks's Sign.—These may be detected by palpation as early as the fourth month. If the hand is placed in full contact with the abdominal contour of the uterus, friction and pressure being absent, and retained there for from five to twenty minutes or less, the gradual relaxation or contraction of the uterine musculature will be felt. These contractions as a rule occur every five or six minutes, while the duration of each

contraction is from two to five minutes. Braxton Hicks says that "if an abdominal tumor thus changes in density and hardness we may be sure that the tumor is the uterus." But Lanier has shown that the same sensations of intermittent contractions may be obtained from a distended bladder. Soft fibroids of the uterus also give these sensations, as well as do the uterine efforts to expel blood-clots, polypi, or retained menses. However, when taken in connection with the other signs of pregnancy, this sign is of great value.

(5) Uterine Murmur, Souffle, or Bruit.—This sound was also wrongly called the "placental souffle" or "murmur," or *bruit placentaire*, by those who regarded it as due to blood rushing through the placental sinuses. Again, it has been called abdominal souffle by others, who think it due to pressure of the pregnant uterus upon the large abdominal vessels. The sound is a single murmur, synchronous with the first sound of the maternal heart. Its quality varies, sometimes being gentle, murmuring, blowing or musical, resembling very much the sound produced by pronouncing "voo" in a low tone. At other times it is harsh, loud, and scraping; while again it may be sibilant, or sonorous. Its rhythm may be continuous and regular, corresponding with the mother's pulse, or it may be distinctly irregular. After once being heard, it may disappear for a few minutes or for several days, and its position is very apt to shift. Sometimes it will persist in a circumscribed spot; again in two spots, one on either side of the uterus; or, again, it will be diffused over the whole anterior abdominal region. The weight of authority is to the effect that this sound originates in the uterine blood channels. The murmur has been observed several days after the birth of the placenta, and no legitimate proof of its origin in the abdominal vessels has been offered. Aside from its variation in position, it frequently varies in duration, intensity, tone, and pitch. It is most frequently detected at the lower part of the abdomen, and this would of necessity be the case in the early part of gestation. Feebleness or death of the fetus has no effect upon it. Only an expert can recognize it before the sixteenth week. It is not a positive sign of pregnancy, for similar sounds may be heard in ovarian or uterine tumors of large size. In labor it is stronger at the beginning of a pain, ceasing altogether at its height, and returning again as the pain declines.

(6) Uterine Fluctuation—Rasch's Sign—may be detected as early as the second month of pregnancy. As in ballottement, two fingers of the left hand are introduced into the anterior vaginal fornix, while the right hand firmly grasps the fundus. Tapping by the fingers of the external hand will transmit an impulse to the internal fingers, the wave being transmitted through the liquor amnii. This sign, considered by many to be of diagnostic value, must not be confounded with Hegar's.

(7) Asymmetry of the Corpus Uteri.—The fact has often been noted that at a very early period of pregnancy the corpus uteri is asymmetrical, one side being thicker than the opposite; while the bulging portion is marked off from the rest of the corpus by a furrow (Fig. 163). This bulge may appear upon any portion of the body of the organ. There is also a difference in the density of the two portions, the prominence being dense and firm, while the rest of the corpus feels elastic (Fig. 163). Braun-Fernwald, who has studied this sign with great care, believes that this asymmetry of the uterus is a necessary result of the implantation of the ovum upon one side of the uterine cavity.* Many authorities believe that this is the earliest and most constant uterine sign of pregnancy.

(8) Uterine Pulse.—The claim has been made that the pulse of the uterine artery, which is ordinarily impalpable, may be recognized early in preg-

* "Wien. klin. Woch.," 1899, No. 10.

nancy. To elicit this sign the organ should be depressed and the artery felt for high up in the lateral cul-de-sac.

2. Vaginal.—(1) Purplish Discoloration of the Vaginal and Vulval Mucous Membranes—Jacquemier's Sign: Congestion of the vulval and vaginal blood-vessels causes, as early as the sixth, but frequently not until the twelfth week, first a violet or light blue, and, as pregnancy advances, a purplish or deep blue tint of the mucous membrane (Fig. 7). In the vulval canal the sign is most intense just below the urethral orifice. This is one of the probable signs of gestation. It is true that pelvic inflammation and tumors may produce the sign, but rarely to the degree caused by pregnancy. (2) Increased Secretion: The vaginal discharges are normally increased during pregnancy, coincident with the hypertrophy of the mucous membrane, and a condition may arise in the perfectly healthy pregnant woman which would be known in the non-gravid subject as catarrhal vaginitis. This is especially common in the latter half of gestation. The discharge is whitish and may be profuse enough to alarm the patient. Endotrachelitis may also be the cause of a vaginal discharge during pregnancy. (3) Temperature: The sensation of increased heat in the genitalia is an important sign. It is due to the augmented blood supply to those parts, to the pathological condition of vaginitis, or to congestive diseases of the pelvic viscera. (4) Vaginal Pulse—Osiander's Sign: During and after the middle third of gestation a distinct pulsation of the vaginal arteries, due to local high arterial tension, may be made out; while not a positive sign of pregnancy, this is a probable one, and is of value in conjunction with others. Non-pregnant conditions, as fibroids and pelvic inflammations, may give rise to the same sign.

3. Abdominal.—(1) Progressive Enlargement: In the beginning of pregnancy there is hypogastric flattening, due to the sinking of the uterus from its increased weight. Later the abdomen enlarges, becoming the shape of a pear, with the smaller end downward. The enlargement first becomes noticeable at the fourth month. The tumor is then in the median line, but later tends to the right. The uterus rises about two fingers' breadth every four weeks. At the end of the third month the fundus uteri is about on a level with the top of the symphysis. During the fourth month it occupies the hypogastrium; at the fifth it is half-way between the symphysis and umbilicus; by the sixth it is at the umbilicus or just above; by the seventh it is half-way between the umbilicus and ensiform cartilage. It reaches the ensiform by the eighth month, where it remains for about two weeks, then sinks a trifle in the last two weeks of pregnancy. It is hardly necessary to state that this is merely a doubtful sign, as abdominal enlargement closely simulating pregnancy may be due to many pathological conditions, such as uterine fibroids, excessive deposition of fat in the abdominal walls, tympanites, ovarian cysts, and other abdominal tumors. (2) Pigmentation (Fig. 161): This, as I have repeatedly demonstrated in the clinic, is in some women entirely absent, thus giving us only a doubtful sign of pregnancy. It has also been observed in cases of ovarian irritation, at the menstrual periods, and in myomata of the uterus. (3) Striæ (Fig. 161): They give us only an uncertain sign of pregnancy, as they may result from excessive non-pregnant enlargement of the abdomen. They are found even in the male. (4) Abdominal Ballottement: During the middle third of pregnancy, by placing the hands upon both sides of the abdomen, where the muscles are not too tense, the fetus may be passed back and forth between the two hands by a series of gentle but decided pushes or taps. This is known as "abdominal ballottement." A tense, resisting abdominal wall, or one loaded with

fat, will obscure all the signs of pregnancy obtainable by palpation. (5) Fluctuation: In the last third of pregnancy, if the palm of one hand be placed upon one side of the abdomen, while the opposite side is lightly tapped, distinct fluctuation may in some cases be elicited. This is naturally an uncertain sign. (6) Changes in the Percussion-note and Umbilicus: Percussion should not be neglected in the examination for pregnancy. This method will yield only negative signs before the end of the third month. In practising percussion in early pregnancy, care should be taken not to mistake the flatness produced by a distended bladder for a pathological tumor of the pelvis or abdomen. Generally the dullness of the uterine body can be detected, surrounded on three sides by the tympanitic intestines. Now and then, however, a few intestinal coils will interpose themselves between the uterus and the anterior abdominal wall, and give a tympanitic resonance in response to tapping. (For changes in the umbilicus, see page 118.)

4. Mammary.—The physical signs include (1) general enlargement; (2) prominence of the veins; (3) pigmentation, forming primary and secondary areolæ; (4) enlargement of the tubercles of Montgomery; (5) prominence, erection, turgescence, and bran-like scales of the nipple; (6) formation of striæ; (7) secretion of colostrum. The presence of secretion is the most valuable of the foregoing signs, and in primigravidous women it is a probable sign of gestation. In multigravidæ it becomes uncertain, though the suppression of milk in a nursing woman has considerable importance in corroborating other signs. Taken alone, these signs are not trustworthy; their absence does not prove the non-existence of pregnancy; they should be supplemented by more positive signs. Uterine or ovarian diseases may be accompanied by many of them, or they may persist a long while after delivery. (See Local Changes Produced by Pregnancy, page 89.) The advantage of mammary changes over other objective signs consists in their early and almost inevitable occurrence, and in the possibility of examining the patient's breasts without rousing her suspicion.

5. Fetal.—(1) Quickening: This term arose from the former erroneous notion that at the time when the mother became conscious of the spontaneous movements of the fetus, life was imparted to the fetus. The active fetal movements are generally first felt by the mother at the end of the sixteenth week. Although perceived by the patient at such a comparatively late period, they really occur very early in embryonal existence, *i. e.*, as soon as the muscular tissue is sufficiently developed to contract. The commonly accepted idea is that they are first perceived by the mother when the uterus has expanded sufficiently to come in contact with the anterior abdominal wall, and thus the fetal movements are transmitted to her sensory nerves. They have been compared, when first felt, to the fluttering of a bird imprisoned in the hand. With advancing gestation these movements increase in vigor, and may even become painful, consisting of sharp, short strokes, or kicks. They greatly increase after fasting, and just before fetal death by asphyxia. They may cease entirely, and the fetus still remain in perfect condition, although their sudden and complete cessation is often coincident with the death of the child. In some cases these movements have never been detected by either mother or physician, and yet at term a perfectly healthy child has been delivered. Pathological conditions, such as hydramnios and ascites, may either partly or wholly obscure these motions. This sign, considered as a subjective symptom, is open to many errors, for irregular muscular contractions of the abdominal muscles, the peristalsis of the intestines, especially when the latter are full of gas, or a wandering kidney,

may cause similar sensations. However, some little value attaches to it from the fact that its first occurrence furnishes a certain datum for the calculation of the time of confinement. When the physician himself feels, or sees, or hears these movements, they constitute a sure sign of the existence of pregnancy, and of the viability of the child. No other movement, normal or abnormal, occurring in the abdomen can ever give a like sensation to the hand of the examiner. After their first detection by the physician, and as gestation advances, they may not only be felt but also seen or heard. Prior to the fourth month, the methods of bimanual palpation, or vaginal stethoscopy, may elicit them occasionally, but after that time abdominal palpation is used. Among these movements should be included fetal hiccough.

(2) Palpation of the Fetus.—About the middle of pregnancy the uterus will have become so elastic, thinned, and compressible that we are able upon palpation to make out the fetus, which is now large enough to be recognized by the abdominal touch. At the end of pregnancy this is of great value in detecting the various positions of the child. Movements of the fetus may be seen by the eye or felt with the hand. In examining for fetal movements, the palm of the hand is placed upon the abdomen, and steady downward pressure is kept up for some moments. Should the movements not be felt, pressure, or a series of gentle raps with the other hand about the first, will generally suffice to produce them.

(3) Heart Sounds.—Mayor, of Geneva, in 1818, discovered that upon applying the ear to the abdomen of the pregnant woman the fetal heart sounds could be heard, and thus the most important sign of pregnancy was brought to light. Kergaradec, of Lausanne, ignorant of the discovery of Mayor, announced the same fact three years later, in 1821. The discovery was accidental in each case. Auscultation in obstetrics furnishes the only sign of pregnancy which, in itself, and in the absence of all others, is perfectly reliable; namely, the heart sounds of the fetus. These sounds are first heard about the middle of the fourth month. They consist of two sounds or beats,—a first sound and a second sound. These two are separated by a slight interval, the first sound being the louder, longer, and more distinct; the second often being almost inaudible. The usual simile used in illustration is the ticking of a watch heard through a pillow. While the rapidity of this sound continues the same throughout pregnancy, the intensity and strength steadily increase. The rapidity and intensity of the fetal heart sounds may temporarily be increased or diminished; thus, the movements of the child may accelerate the pulse several beats per minute, and at the same time increase its intensity. On the other hand, during labor and after the escape of the liquor amnii, the contractions of the uterine walls may greatly depress the heart, and this fact is one indication for interference in prolonged or retarded labors. The position, or point of the greatest intensity, of the fetal heart sounds will vary with the position of the child in the uterus. In head presentations the fetal heart is most frequently heard at a point half-way between the umbilicus and the left anterior superior spine of the ilium, the reason for this being that the most frequent position of the fetus is with its back anterior and directed a little to the left side of the mother. The next most frequent site will be on the same level, but upon the right side. In breech cases, on the other hand, the fetal heart is best heard above the umbilicus, on either side of the median line, according to the position of the child, the sound of the heart being naturally heard with greatest intensity at that point where the back of the child touches the uterine wall. Like all vascular sounds, it is transmitted better through solid than fluid media. When the fetal heart sounds are heard

distinctly, they furnish an absolute and certain physical sign of pregnancy. It is the surest sign, and is readily recognized after the fourth month. It is entirely beyond the control of the patient. The only other sign of equal value is recognition of the fetus by abdominal or vaginal palpation. The sound of the fetal heart not only makes it positive that pregnancy is present, but also that the child is living. The fact that it is not heard, however, does not negative pregnancy, for the fetus may be dead, or the sounds for a time inaudible; the maternal abdominal walls may be very thick and fat; the fetal back may be posterior; the intestines may be full of gas; hydramnios may be present. The rate of the fetal heart sounds and that of the mother's do not correspond. The fetal heart beats from 130 to 150 times a minute. It is slightly more frequent

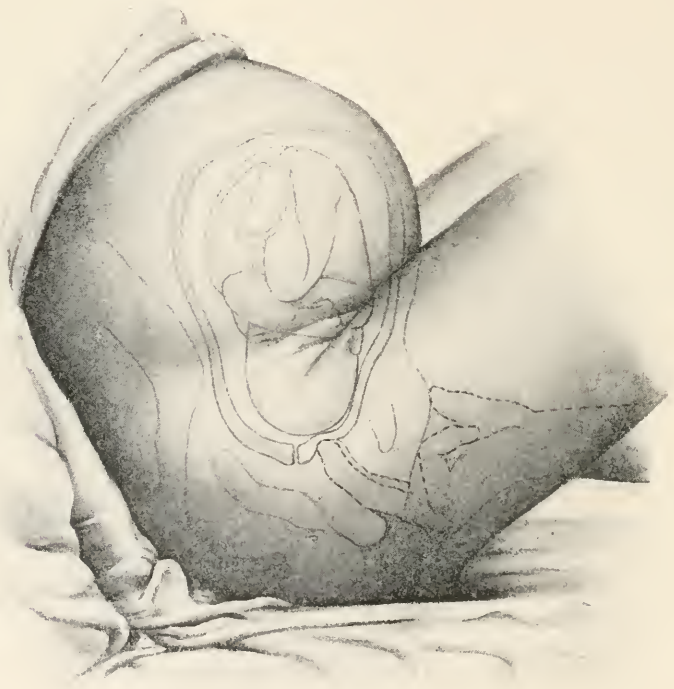

FIG. 170.—INTERNAL BALLOTEMENT AT THE SIXTH MONTH. PATIENT IS IN THE RECLINING POSTURE.

in small than in large children. Attempts have been made from this to predict the sex of the child, since males are usually larger than females. When the sounds are distinctly heard, but the uterus is too small to contain a fetus old enough to make them, there is a strong indication of extrauterine pregnancy.

(4) BALLOTTEMENT.—In the latter part of the fourth month, or the first part of the fifth, ballottement may be practised. The preferable position for the patient is reclining, midway between standing and sitting, although either of the latter positions may be assumed (Fig. 170). Ballottement is the earliest of the positive signs, as it may be obtained from the fourteenth or fifteenth week till within six or eight weeks of delivery. In practising ballottement the examining finger is introduced into the vagina and suddenly pushed up

against the lower portion of the uterus. The impulse thus generated is transmitted to the fetus, which bounds upward and then falls back upon the examining finger (Fig. 170). This is a physical sign of pregnancy which, when clearly made out, is infallible; for although an anteflexed fundus, or a calculus in the bladder, or some other pathological conditions, may give rise to very similar sensations, still, in such cases, no other signs of pregnancy will be present. Before the end of the fourth month the fetus is too small to respond to the digital impulse, and after the seventh month the child is relatively too large, so nearly filling the uterine cavity that it cannot be moved about as freely as formerly. In multiple pregnancies, and in deficiency of the liquor amnii, the

FIG. 171.—AUSCULTATION OF THE FETAL HEART WITH THE PHONENDOSCOPE. Method of raising the fundus of the uterus upward and forward so as to bring the uterine walls close to the abdominal parietes and thus intensify the fetal heart-sounds.—(*From a photograph at the Emergency Hospital.*)

sign will be absent for the same reason. Neither shoulder nor breech presentations, as a rule, respond to this test.

(5) UMBILICAL MURMUR, OR SOUFFLE, consists of a slight blowing murmur, synchronous with the fetal heart sounds, and most distinctly heard in their vicinity. The sound can be detected in about 15 per cent. of all the cases of pregnancy, and is thought to be due to pressure upon the umbilical cord, from its coiling, or from some form of compression. Its position varies with the presentation of the child. Its practical value is *nil.*

6. Sympathetic and Reflex.—(1) NAUSEA AND VOMITING; MORNING SICKNESS. (See Digestive System, page 115.) (2) SYMPATHETIC DISTURBANCES OF THE NERVOUS SYSTEM, such as changes in disposition and taste, have no

value in the diagnosis of pregnancy and have been described under The Phenomena of Pregnancy.

7. Pressure and Congestion.—The neighboring organs are disturbed by the growth and development of the uterus, these disorders depending partly upon hyperemia and partly on mechanical pressure. (1) BLADDER: The bladder becomes irritable; during early pregnancy frequent micturition, incontinence, and vesical tenesmus are common symptoms. In a woman previously free from vesical irritation, this symptom, in conjunction with cessation of menstruation, we have frequently found most valuable, and we would class it as a probable sign. In our experience, persistent vesical irritation is the most valuable of the very early symptoms. (See Bladder, page 112.) (2) RECTUM: In the latter months fecal accumulations in the lower bowel cause much irritation and discomfort. (3) LOWER EXTREMITIES: Sciatica, œdema, and varicosities are frequently observed as the result of pressure.

8. Cutaneous.—Pigmentation of the forehead and cheeks, in the form of dark brown patches termed chloasmata, or blotches, is found in some pregnant women, especially brunettes. These patches, as well as the dark circles about the eyes, are most uncertain signs, and are found occasionally during menstruation and in ovarian and uterine disease. Pigmentation and striæ of the breasts and abdomen have already been classified under Mammary and Abdominal Signs.

9. Individual and Subjective.—A woman who has borne many children is often better able to tell when she has conceived than is the most skilful diagnostician. Under these circumstances the truth is reached by individual or idiosyncratic phenomena. Dismissing as entirely untrustworthy the existence of peculiar sensations during the impregnating coitus, there can be no doubt that individual signs may appear within a few days after conception. One woman under these circumstances experiences a characteristic vertigo, another nose-bleed, a third pruritus vulvæ, a fourth swelling and tenderness in the veins of the lower extremities (in cases of past puerperal phlebitis). The various sensations experienced have an individuality which is never noticed on any other occasion.

SUMMARY OF THE DIAGNOSTIC SIGNS OF PREGNANCY.

The symptoms and signs of pregnancy may be divided into three classes: (I) Doubtful; (II) probable; (III) certain. The first may occur in the male. The second have to do only with the genitals of the woman. The third are produced only by the presence of the fetus. (I) To this class belong all those signs dependent partly on pressure, and partly on blood changes, or alterations in nervous activity. These are nausea, vomiting, fainting, varicosities, œdema, headache, toothache, and backache, also pigmentation of the skin, frequent micturition, and "longings" or "cravings." These signs are almost valueless; save in cases of multiparæ, who, never having suffered otherwise from any of these symptoms, have noted a certain syndrome in every pregnancy. In some instances nausea, vomiting, and depressed spirits have occurred almost immediately after a fruitful coitus, so that the patient was aware of her condition before the cessation of the menses. (II) The next group proceeding from the female genitalia is of more importance and comprises: (*a*) cessation of the menses. (*b*) The changes in the color of the vulva, vagina, and uterus; the palpable pulsation in the vaginal fornices; the increasing size of the uterus; the rounding of the external os; and the softening, elasticity, and thinning of the uterus just above the insertion of the sacro-uterine ligaments. (*c*) The uterine souffle.

(*d*) Breast changes. (*e*) The striæ and umbilical changes. (III) The certain signs are: (*a*) Mapping out of the fetus. (*b*) Fetal heart sounds. (*c*) Movement of the child as felt by the examiner. (*d*) Umbilical murmur.

To recapitulate:

I. The Positive or Certain Signs are: (1) Mapping out the whole or parts of the fetus by palpation. (2) The fetal heart sounds. (3) Movements of the fetus, active or passive; to be regarded only when confirmed by an experienced observer. (4) Vaginal and abdominal ballottement. (5) The umbilical or funic murmur, in the 10 or 15 per cent. of cases in which it is present, is also a certain sign.

II. The Probable Signs are: (1) The progressive enlargement of the uterus and its characteristic alterations in shape. (2) The compressibility of the lower uterine segment—Hegar's sign. (3) Intermittent uterine contractions—Braxton Hicks's sign. (4) Changes in consistency of enlarging uterus. (5) Changes in consistency and color of vagina and cervix. (6) Uterine murmur. (7) Cessation of menstruation. (8) Mammary signs—enlargement of breasts and Montgomery's tubercles. (9) Pigmentation and secretion.

III. The Uncertain or Doubtful Signs are: (1) Changes in size and shape of abdomen as well as pigmentation, striæ, fluctuation and changes in the percussion note. (2) Sympathetic and reflex disturbances—nausea, vomiting, alterations in taste and disposition. (3) Pressure and congestive signs—irritable bladder or rectum, pain, and œdema in lower extremities. (4) Cutaneous signs—chloasmata on the forehead and cheeks and dark circles under the eyes. Pigmentation and striæ of the abdomen and breasts have already been classified.

The signs of pregnancy may be classified, finally, according to the time at which they appear. **First month:** The abdominal changes begin to appear. There is cessation of menstruation. It is early for the manifestation of morning sickness, and for changes in the breasts, though they may take place. The cervix begins to soften from the very first. **Second month:** Hegar's sign may now be obtained. There is pulsation in the vaginal vault. This month is the ordinary time for the beginning of mammary and gastric changes. Depression of the umbilicus persists, and the uterus sinks, while the abdomen is flat. **Third month:** The umbilicus is still depressed, and the uterus sunken till the end of this month, when it begins to rise. The softening of the cervix increases in extent. Gastric and mammary changes continue. **Fourth month:** The uterus begins to rise, consequently the depression at the navel commences to fill out, and the abdomen to become prominent. The breast changes increase, but as a rule the gastric disturbances cease. At the end of the month the heart sounds may rarely be heard. The uterine murmur is present. The patient sometimes feels quickening, and the examiner may detect fetal movements, as well as uterine contractions. **Fifth month:** Normally at this time the gastric disturbances have entirely ceased, and the appetite and digestion are excellent. The abdomen is plainly increased in size, and frequently quickening is felt. The mammary changes continue, with the appearance of the secondary areola. Ballottement readily reveals the presence of the fetus and heart sounds are plainly audible. **Sixth month:** The sounds and motions of pregnancy are all evident. In multigravidæ the external os is patulous, admitting a finger-tip. The fundus is about at the level of the navel. Cutaneous striæ develop. **Seventh month:** The external os may now, even in primiparæ, admit the finger-tip. The cervix is more elevated in the vagina. The fundus is two inches above the umbilicus. Ballottement is still obtainable. The vaginal part of the cervix is apparently shortened one-half. Cutaneous striæ continue

to develop. **Eighth month:** Ballottement is hardly obtainable. The fundus is halfway between the umbilicus and the ensiform cartilage. The abdomen is much enlarged, and is pear-shaped. The umbilicus may begin to pout at the end of this month, and in multigravidæ milk may be secreted. Fetal parts are easily palpable. **Ninth month:** Ballottement is no longer obtainable, although the other physical signs are all more marked. The fundus, at the end of this month, is almost at the ensiform cartilage. The cervix still seems shorter. The os is very patulous, especially in multigravidæ. The umbilicus protrudes. **Tenth month:** The physical signs are distinct. At the middle of this month the fundus is at its greatest height. It settles down in the last two weeks, thereby lessening the pressure symptoms, while the os also sinks and the umbilical prominence decreases. The patient feels lighter and more comfortable. There may, however, be difficulty in locomotion and œdema of the genitals and legs. The vertex is usually engaged in the pelvis in primigravidæ and at the inlet in multigravidæ. The cervical canal in primigravidæ shortens and disappears just before or at term, and in multigravidæ several days or even weeks before labor.

IV. THE DIFFERENTIAL DIAGNOSIS OF PREGNANCY.

1. Non-pregnant Enlargements of the Uterus.—(1) *Hematometra*, usually due to retained menses, is a rare condition; non-appearance of menstruation occurs with imperforate hymen, or obstruction in the cervical canal, and the

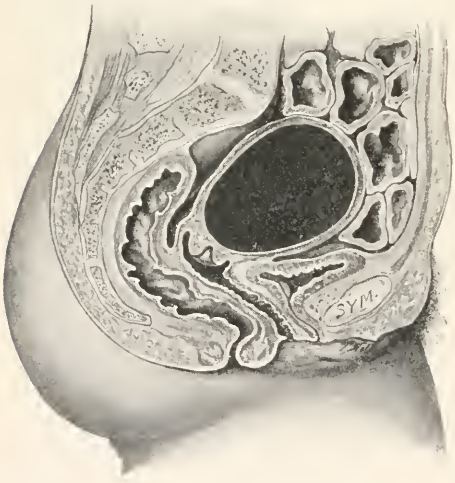

FIG. 172.—HEMATOMETRA. A NON-PREGNANT ENLARGEMENT OF THE UTERUS.—(*Montgomery.*)

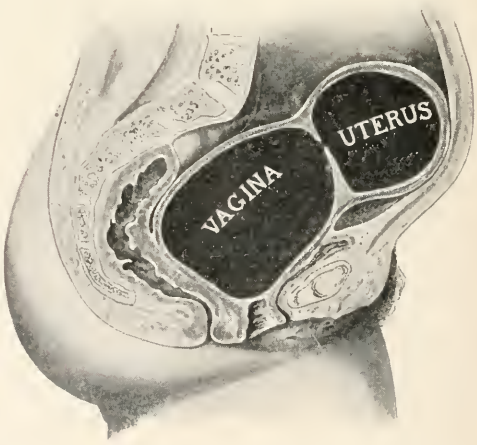

FIG. 173.—HEMATOCOLPOMETRA. A NON-PREGNANT ENLARGEMENT OF THE UTERUS. —(*Montgomery.*)

tumor develops slowly with periodic increase in size (Figs. 172 and 173). (2) *Hydrometra* may be due to the closure of the external or internal os, or both, with catarrhal discharge from the mucous membrane, which by its accumulation causes enlargement of the uterus. At times a watery fluid accumulates in the

uterus; this condition is rare, and is very seldom seen before the menopause. (3) *Physometra* is due to the generation and retention of gas in the uterus. This is, indeed, a tympanites of the latter. When the uterus has reached such a size that it may be percussed, resonance is obtained. Sometimes foul-smelling gas escapes per vaginam, and when the uterus is raised its weight does not correspond with its size, the organ being much lighter than would be supposed from its appearance. (4) *Pyometra* consists in the accumulation of pus in the uterine cavity. Hematometra, hydrometra, physometra, and pyometra are very rare conditions, while pregnancy is very common. The first three conditions consist in the distention of the uterus by blood or other liquid, or by gas of some sort. The atresia which produces these conditions may be congenital or acquired. There is no history of exposure to impregnation, as there is in pregnancy; the menses are absent, as a result of imperforate hymen, or of traumatic or inflammatory occlusion of the cervix. In pregnancy there is the normal history of menstruation with the sudden cessation of its appearance.

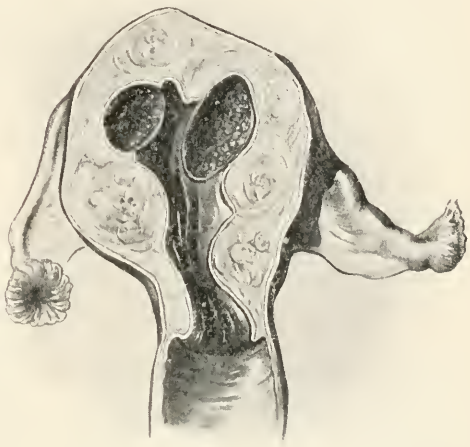

FIG. 174.—DIFFUSE INTERSTITIAL MYOMATA. A NON-PREGNANT ENLARGEMENT OF THE UTERUS.—(*Montgomery.*)

FIG. 175.—LARGE MYOMATA OF ANTERIOR AND POSTERIOR UTERINE WALLS. A NONPREGNANT ENLARGEMENT OF THE UTERUS.—(*Montgomery.*)

In these abnormal conditions there is a history of a slowly developing tumor, with sudden and periodic enlargement, followed by slight decrease in size. These periods correspond to the menstrual epochs and are characterized by great pain. The duration greatly exceeds that of pregnancy. By physical examination in pregnancy the vagina is found congested and softened, while in these diseased conditions it is generally discovered to be abnormal in some respect. The mammary changes in pregnancy are suggestive. (5) *Chronic Metritis* gives the uterus a firmer resistance than is imparted by pregnancy; Hegar's sign is not present, nor is the characteristic "pot-bellied" shape of the uterus of pregnancy. Amenorrhea is often present, and a purulent secretion frequently coexists. (6) *Subinvolution* is generally accompanied by pain in the dorsal or

ovarian regions, with tenderness of the uterus itself. There is a history of very abnormal menstruation, together with a bloody, muco-purulent leucorrhea. There is no increase in the size of the uterus, nor are there any signs of pregnancy. Locomotion is difficult, and the patient may have amenorrhea from anemia or lactation. (7) *Myoma and Fibroma:* These tumors are usually irregular, firm, dense, and not necessarily in the median line. Menstruation is irregular and profuse, and the uterine evidences of pregnancy are mostly absent, especially the Hegar and Braxton Hicks signs; on the other hand, asymmetry and the uterine souffle are sometimes demonstrable. There is, further, a history of slow and protracted growth, which may extend over months or even years (Figs. 174, 175, 176, and 177). (8) *Congestive Hypertrophy of the Uterus:* This affection is not infrequently mistaken for pregnancy, especially when accompanied by amenorrhea. However, in this condition the uterus is apt to be tender and the seat of considerable pain. Time will give the correct diagnosis.

FIG. 176.—LOCAL INTERSTITIAL MYOMATA. A NON-PREGNANT ENLARGEMENT OF THE UTERUS.—(*Montgomery.*)

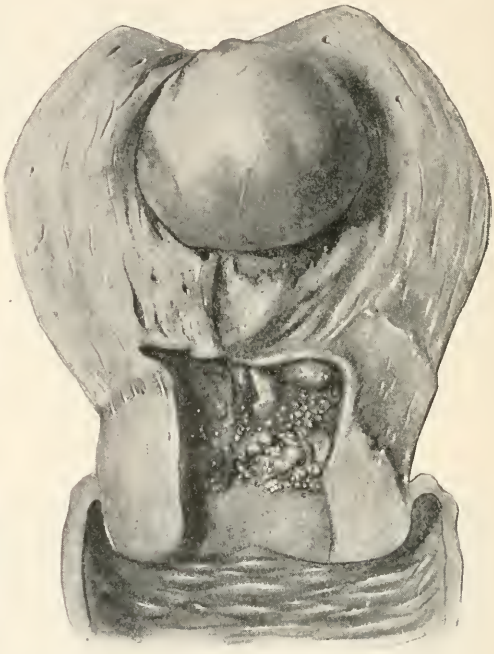

FIG. 177.—MYOMA OF THE BODY AND CANCER OF THE CERVIX. A NON-PREGNANT ENLARGEMENT OF THE UTERUS.—(*Montgomery.*)

2. Uterus Normal in Size with Extrauterine Enlargements.—(1) *Abdominal Fat:* This condition becomes more common as age increases. It usually simulates pregnancy in the very young and anemic. Menstruation in the obese is often irregular and scanty. The cervix is neither enlarged nor softened. A uterus of normal size may be recognized by the vaginal or rectal touch, and if the abdominal fat can be pushed aside a tympanitic resonance may be obtained over the umbilical region. (2) *Distended Bladder:* The duration of this condition is relatively brief. There are external discomfort and dribbling of urine. The position, shape, and resistance resemble those of the pregnant uterus. In retroflexion of the uterus the distended bladder is often mistaken for the uterus. Catheterization of the bladder will at once clear up the diagnosis.

(3) *Fecal Accumulation* sometimes produces enlargement of the abdomen. Catharsis and enemata will remove this condition. (4) *Ovarian Tumor* (*Cystoma*) (Fig. 178): In this condition most of the probable signs of pregnancy are absent. The abdominal tumor is soft, fluctuating, and usually unilateral. A normal uterus should be made out by direct examination. There is also a history of a slowly growing unilateral tumor, with the presence of the cachexia and facies which accompany ovarian tumors. There may, however, be coexistence of the two conditions, which makes the diagnosis difficult. The two tumors will then be of different consistence, and may have a groove between them. Vaginal examination will reveal enlargement of the uterus, while there are also present the signs of ovarian cyst. There should be further evidences of pregnancy. Aspiration of the ovarian tumor is no longer practised, as in this procedure there is nothing to be gained in making the diagnosis. (5) *Ascites:* In this condition the certain and probable signs of pregnancy are all absent and the cervix and body of the uterus possess normal characters. The abdomen, flattened in front and bulging at the sides, exhibits fluctuation. By changing the woman's position the horizontal limits of percussion-resonance change. In the dorsal position there is dullness in the flanks on percussion. The condition upon which the ascites depends may be in evidence (cirrhosis of the liver, tuberculous peritonitis, etc.). (6) *Pelvic Hematocele:* This condition, which usually occurs in the broad ligament, could hardly be mistaken for pregnancy. (7) *Pelvic Exudations:* The uterus may be surrounded by pelvic exudate, the whole representing an apparently homogeneous swelling. (8) *Retroversion and Retroflexion:* These conditions have been mistaken for pregnancy at times, since they frequently cause hypertrophy of the uterus, and irregularities or cessation of the menses. The history must be carefully investigated. Vaginal examination generally discloses an anteposed cervix of firm consistence. The tumor will also be found situated in Douglas's cul-de-sac. Very careful examinations, repeated at short intervals, will reveal the true nature of the case. Sometimes several months will be required to make the diagnosis certain. The greatest difficulty will be found in those cases in which the fundus has reached the superior margin of the symphysis, or a little higher, before the convincing signs of pregnancy are present, and when the fetus is dead. Time is often required for clearing up this diagnosis. Large tumors should generally offer little difficulty, but the possibility of the coexistence of pregnancy and a tumor should always be remembered. (9) *Tympanites:* In this condition the whole abdominal surface will give a clear note of percussion; the signs of pregnancy, both subjective and objective, are all wanting. Tympanites and pregnancy may coexist, however. Tympanites may be excluded by feeling the spinal column through the abdominal wall. This may be accomplished by firmly pressing the hands, one on the other, against the abdomen, while the patient draws deep breaths. The pres-

FIG. 178.—INTRALIGAMENTOUS MYOMA. UTERUS NORMAL IN SIZE WITH A PELVIC TUMOR.—(*Montgomery.*)

sure should be especially firm during expiration. In this way the absence of a gravid uterus may be proved. The enlargement also varies in the two conditions: in pregnancy it is chiefly antero-posterior in the first months, while in tympanites it is uniform in all directions. There should be no resonance over the uterus, since the intestines, as a rule, are above and behind the organ. As before noted, however, the intestines may be forced over the anterior face of the uterus from gaseous distention. (10) *Distended Tubes*, perhaps adherent to the uterus, might possibly simulate pregnancy. In this case they will move with the cervix. (11) *Encysted Peritonitis* and (12) *Ectopic Gestation* may sometimes cause confusion. (13) *Enlarged Abdominal Organs* may suggest pregnancy; they, however, increase from above downward. In case of wandering spleen or kidney, the organ can be pushed upward. Resonance may be obtained below the limit of dullness and will show the cause of enlargement. Encysted dropsy may be met with, but very infrequently. In malignant growths of the omentum and mesentery there are irregularity and fixation. If the growths are extensive and have existed for some time, there is apt to be cachexia.

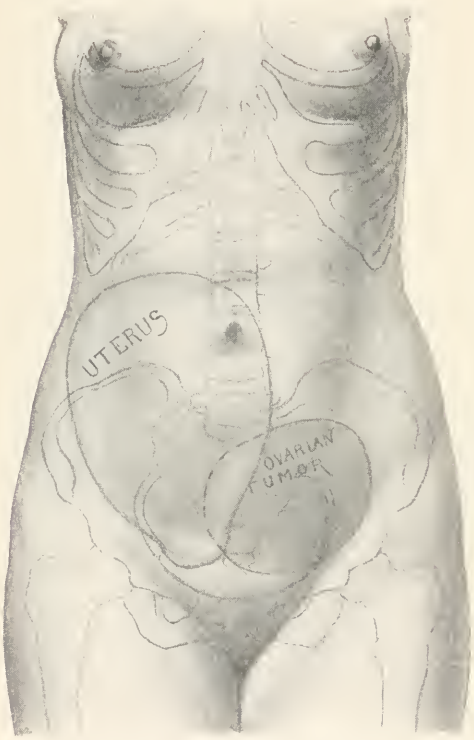

FIG. 179.—AN OVARIAN CYST BEHIND AND TO ONE SIDE OF A PREGNANT UTERUS. PREGNANCY WITH A PELVIC TUMOR.—(*Montgomery.*)

3. Pregnancy with Extrauterine Enlargements.—The physician must be on his guard against a combination of these conditions; for example, intrauterine pregnancy and ectopic gestation may exist together; or one of these conditions with an ovarian tumor; also in intrauterine pregnancy the uterus, from retroflexion, or retroversion, or both, may give the appearance of a tumor in Douglas's cul-de-sac. Abdominal enlargement from pathogenic conditions sometimes occurs in combination with pregnancy. In these cases the latter condition is very apt to be overlooked, while the former is the only one recognized. In certain cases the pathological conditions may be removed, and then the pregnancy will become apparent. The abdominal walls also may contain an undue amount of fat, which will tend to obscure the gestation. (1) Ascites may coexist with pregnancy and in various clinical forms, due respectively to (*a*) tuberculous peritonitis, which may develop slowly side by side with gestation; (*b*) some obstruction of the portal circulation (cirrhosis of the liver, pylephlebitis); (*c*) obstruction of the circulation of lymph; and, finally, (*d*) pregnancy itself, which may produce ascites as a result of a pathological condition which affects the maternal peritoneum and fetal amnion. (2) Ectopic pregnancy may be associated with normal uterine gestation, and the presence of the latter furnishes a contraindication to the operative treatment of the former, although in cases

of this description both fetuses have been delivered alive by laparotomy. As a rule, the embryos have the same degree of development. Normal pregnancy may also be associated with a past extrauterine gestation. (3) There may also be coexistence of uterine and cornual pregnancy; this latter condition often so nearly resembles ectopic gestation that it cannot always be differentiated from it. (4) Persistent distention of the bladder may sometimes obscure beginning pregnancy. It would be almost impossible to confuse the (5) tumor of appendicitis with beginning gestation. (6) Ovarian tumors not infrequently complicate pregnancy; this combination may give rise to much danger to the mother, for it will be almost impossible for the abdomen to accommodate both of these tumors, growing simultaneously (Fig. 179). Sometimes the tumor is subjected to such pressure that it may burst and discharge its contents into the peritoneal cavity; or it may give rise to a slow inflammatory process, causing much exhaustion, and finally terminating fatally. Several lines of treatment are suggested—ovariotomy, or induced labor. (7) At times small tumors develop, which may gradually rise above the brim. In this case, if the tumor is not behind the uterus, it may be distinguished from that organ. On the other hand, the abdomen may be so distended by the presence of the gravid uterus and the tumor that hydramnios or twins may be suspected. (8) Pyosalpinx or hydrosalpinx may also complicate pregnancy. (9) Other tumors of the soft parts have at times to be considered; *e. g.*, those of the broad ligaments, tubal and other swellings. (10) Ventral hernia and pendulous abdomen must be distinguished. (11) A large floating kidney, or displaced spleen or liver, or tumors of any of the abdominal viscera, such as hydatids of the liver, or carcinomatous tumors, may be found in conjunction with pregnancy, as has been stated.

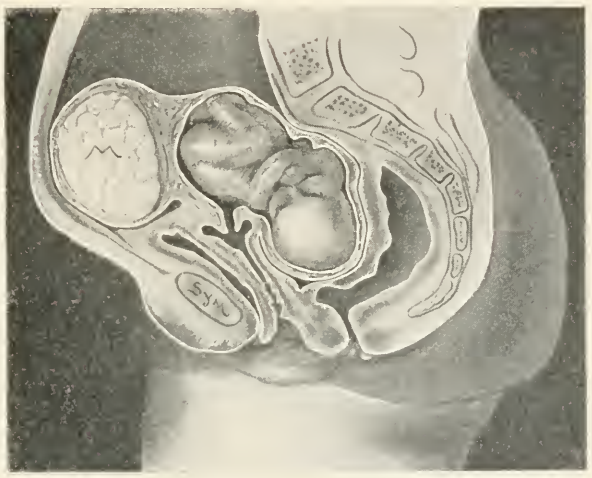

FIG. 180.—PREGNANCY COMPLICATED BY MYOMA OF THE ANTERIOR UTERINE WALL. PREGNANCY WITH A PELVIC TUMOR.—(*Montgomery.*)

In some conditions it is possible to remove the trouble which obscures the pregnancy, and then the latter stands out clearly. However, the best way of making a true and positive diagnosis of the pregnant state is to make several examinations, and to wait until undeniable proofs of gestation are present. There is one differential point of great value in the diagnosis of pregnancy: after the sixth month it is the only abdominal tumor which presents the condition of a movable solid mass in a liquid.

From a medico-legal standpoint the diagnosis between a multiparous and puerperal uterus, and between a primigravida and multigravida, sometimes becomes important. *Multiparous Uterus:* Cavity 2½ inches (6.5 cm.), triangular; cervix small, cartilaginous, and same length as body; external os transverse, and edges smooth; uterus anteflexed; external os closed. *Puerperal*

Uterus: Cavity 3 inches (7.5 cm.), or over, oval; cervix large, soft, larger than body; irregular external os, with roughened edges; axis of uterus straight, retrodisplaced; external os patulous. *Primigravida:* Fourchette present; perineum intact; labia in apposition; granular condition of vagina present; cervix long, conical, or closed; abdomen tense; pinkish striæ, late in pregnancy; breasts full, firm, sensitive; nipples undeveloped; striæ usually absent from breasts. *Multigravida:* Fourchette absent; perineum relaxed or torn; labia frequently patulous; granular condition of vagina absent; cervix short and open; abdomen relaxed; white striæ, from beginning of pregnancy; breasts relaxed; nipples large and developed; striæ frequently present on breasts.

V. FEIGNED PREGNANCY, PSEUDOCYESIS.

Pregnancy, for various reasons, may be feigned or simulated. Suits are frequently brought for damages, or to compel marriage, and it then becomes the duty of the physician to render a decision in the case. The pregnancy may be purposely feigned or simulated, or the woman in question may really

FIG. 181.—AUTHOR'S CASE OF FEIGNED OR FALSE PREGNANCY (PSEUDOCYESIS) AT THE THIRTY-SIXTH WEEK (?). A bimanual examination revealed a uterus normal in size and position.—(*From a tracing.*)

believe herself to be pregnant. The latter condition is one well recognized in obstetric medicine; and constitutes what authorities variously term false, spurious, or nervous pregnancy, or pseudocyesis. In cases of feigned or simulated pregnancy, a physical examination removes all doubt; for although the woman may simulate many of the doubtful signs of pregnancy in her attempt

to deceive, yet an examination reveals none of the probable or sure signs, and the uterus is found of normal size (Fig. 181). Pseudocyesis is observed in women who are advanced in years; in those who have an intense desire to become pregnant; in women who marry late in life, and are anxious to prove their power of reproduction. Most frequently we observe the condition in a woman who is approaching the menopause, when her menstrual flow has become scanty, or has ceased outright for a time; a deposit of fat takes place in her anterior abdominal walls, and her intestines become distended by flatulence. In such a case many of the doubtful and some of the probable signs of pregnancy are present. For example, menstruation may cease; the mammary signs of gestation appear, even to the secretion of colostrum or milk; the abdomen becomes progressively more prominent; the woman assures her physician that fetal movements (quickening) are present; and this may end in what is termed spurious labor. (See Part IV.) The diagnosis of the condition is not difficult. Above all, the physician should be on his guard against accepting any statements the patient may offer in regard to her condition; and in expressing an opinion, he should rely upon the exclusion of the probable and certain signs of gestation, which he does by a careful physical examination of the woman, preferably with the aid of anesthesia.

In the Robert Ray Hamilton case, which occurred in New York in the latter part of 1888, Mr. Hamilton's mistress represented to him that she was pregnant by him. He believed this to be the case, and gave her considerable sums of money to enable her to go into the country to be confined. She went away, remained a few months, and upon her return produced a child which she stated was the child born at her alleged confinement. He fully believed her story and accepted the child as his own. It appears from the police memoranda that several children were bought from midwives for sums of from ten to fifteen dollars, and that two of these died while acting their parts as supposititious children. Owing to a quarrel between nurses, the fraud was finally discovered, and the woman and her accomplices were indicted for obtaining money under false pretenses. The indictment never came to trial.*

VI. UNCONSCIOUS PREGNANCY.

It is not only possible, but quite common, for women to become pregnant and remain so for some time before they become aware of their condition. This applies more particularly, if not exclusively, to those who are married. In the unmarried, in spite of their serious protestations of entire ignorance of everything concerning the matter in question, unconscious impregnation and pregnancy is a rare condition. Many cases may be furnished of married women, especially those childless for a number of years, who finally really do become pregnant, and then refuse to believe the medical attendant when assured that such is the case, believing their altered condition to be due to some disease. "When a woman is impregnated in a lethargic state, it is unlikely that she should go beyond the sixth month without being fully aware of her pregnancy; and if her motives were innocent, she would undoubtedly make some communication to her friends" (Taylor). It must be borne in mind, however, that it is possible for a woman to carry her child to full term and be unconscious of the fact of pregnancy.†

* For illustrative cases of feigned pregnancy, see author's article, "Pregnancy, Labor, and the Puerperal State," "Medical Jurisprudence, Forensic Medicine," Witthaus and Becker, vol. II, p. 336.

† Turner, "London Obstet. Trans.," vol. IV, p. 113; also "London Lancet," 1861, i, pp. 609–643. For illustrative cases of unconscious pregnancy, see author's article on the subject in Witthaus and Becker, "Forensic Medicine," vol. II, pp. 362–364.

VII. MULTIPLE PREGNANCY; SUPERFETATION.

Definition.—If more than one ovum becomes impregnated at the same or different dates, the result is multiple pregnancy; as twins, triplets, quadruplets, quintuplets, sextuplets. Fecundation of an ovum with a double yolk may occur. Several cases of six children at a birth have been reported.

Frequency.—Twins occur once in ninety cases; triplets once in eight thousand; quadruplets once in four hundred thousand. Multiple pregnancies are more frequent in certain countries than others; for example, Bavaria, Ireland, and Russia. In 2200 labors I found twins in 31 cases, or once in 70 cases, or 1.40 per cent.

Etiology.—The most important factor in the causation of multiple pregnancy is heredity, and it shows itself on the maternal side especially. In women who have once given birth to twins, an increasing tendency seems to be present for multiple pregnancy in subsequent gestations. Multiple pregnancy may arise (1) from one or more ova in a single uterus; (2) from two or more ova impregnated in a double uterus; (3) from one ovum or more in the uterus, and one extrauterine. In this connection two analogous conditions, termed superfecundation and superfetation respectively, must be considered.

Superimpregnation; Superfecundation; Superfetation.—The term superimpregnation indicates the impregnation of two or more ova at the same coitus; simultaneous fecundation. By the term superfecundation is meant the impregnation of one ovule or more after one has been already impregnated; or the fertilization of one ovum or more of the same ovulation, at a second coitus, after one has been already fecundated—successive instead of simultaneous fecundation. The result of superfecundation is simply multiple pregnancy, but the children may or may not differ, according as they possess the same father or different fathers. By the term superfetation is meant impregnation when an embryo already occupies the uterus, or the fertilization of a second ovum after the development of the first ovum has been going on in the uterus for a month or more. Two results may follow: (1) Two children are born at the same time, but different in development; or (2) two children are born at different times, equally developed.

If all of the above conditions are possible, we may have as the result of superfecundation: (1) The birth of twins or triplets, with certain physical peculiarities, proving that they have had different fathers. And as the result of superfetation: (2) The birth of children at the same time, differing in the degree of their development; or, (3) after the birth of a mature child, a second one equally developed may be born, after the lapse of several weeks or months. That superfecundation may occur in both women and the lower animals is now a matter of certainty. A mare is covered by a stallion, and after an interval of several days, is covered by an ass; the result is twins,—one a horse, the other a mule (Mende). A setter bitch during the same ovulation (heat) is covered successively by a pointer and a mastiff; her puppies plainly indicate the different fathers. Medical literature supplies abundant cases to illustrate superfecundation in woman.

For superfetation to be possible, the occurrence of ovulation is required several weeks or months after the fertilization of the first ovum. The physiological law in woman is for ovulation to cease as soon as impregnation takes place. Nature seemingly intended woman to be uniparous, although we see the exceptions in multiple pregnancy. The believers in superfetation lay stress

upon the fact that because women apparently menstruate for one or more periods during pregnancy, therefore ovulation occurs at the same time. Playfair cites the presence of menstruation as a proof of ovulation. As has already been pointed out, the presence of menstruation is no proof that ovulation is also present. (See Duration of Pregnancy.)

Conclusions.—(1) Superfetation has, in many instances, been assumed to exist without sufficient evidence. (2) There are on record cases that we are unable to explain on any other ground than that of superfetation. (3) Whether in all cases of apparent superfetation the uterus was normal, is not definitely known. The result of all the observations made upon this subject is, that the majority of the alleged cases of superfetation may be explained (1) upon the theory of twin pregnancies, in which one fetus has grown at the expense of the other and is first expelled, the other remaining until it has acquired the proper maturity; (2) by the existence of a double uterus (Fig. 457). Nevertheless there are a few other cases which do not admit of either of these explanations, and which cannot be accounted for except on the theory of two successive conceptions (Reese).

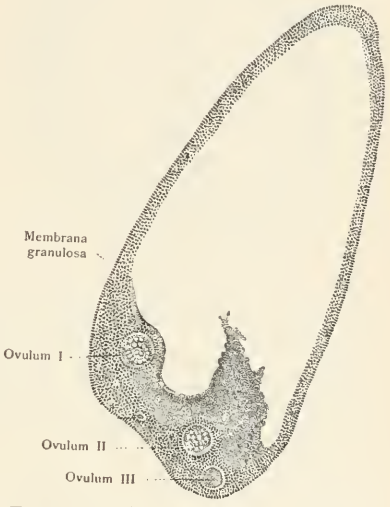

FIG. 182.—GRAAFIAN FOLLICLE WITH THREE OVA.—(*Von Franque.**)

Explanation of Multiple Pregnancy.—There are various causes for the occurrence of multiple pregnancies. The most frequent is probably the coincident, or almost coincident, rupture of simultaneously matured Graafian follicles, whose ova are impregnated at the same, or very nearly the same, time. As a general rule, twins develop from two distinct ova, which are derived from the same or different Graafian follicles. They may be situated in different ovaries, as proved by the presence and position of the corpora lutea. So twins may be derived (*a*) from one ovum from each ovary; (*b*) from two ova from one ovary; (*c*) from a double ovum, both nuclei being fertilized (Fig. 183); (*d*) from a division which takes place in the blastoderm, giving rise usually to monsters, but sometimes to twins (Fig. 93). The presence of a double nucleus may be assumed when twins are derived from a single ovum, but, as emphasized by Ahlfeld in his researches on the production of double monsters, the possibility must be entertained that the twins may have resulted from complete fission of a single germ. The twins are then termed "homologous," and their mental and physical similarity is striking. Twins originating from a single ovum are always of the same sex, while those from two ova may be of the same sex or of different sexes. Triplets may be derived from one, two, or three ova. A common method is for one child to originate from one ovum, while the other two are derived from another single ovum. The arrangement of the placentæ and membranes will depend upon the

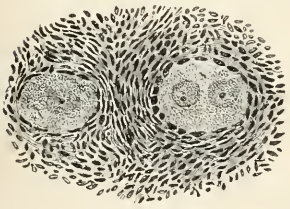

FIG. 183.—TWO PRIMORDIAL FOLLICLES IN ONE OF WHICH IS AN OVUM WITH TWO GERMINAL VESICLES.—(*Von Franque.*†)

* "Zeitschrift f. Geburts. u. Gynäkol.," Bd. xxxix.

† "Zeitschrift f. Geburts. u. Gynäkol.," Bd. xxxix.

method of their origin. Quadruplets may consist of double twins, or of triplets together with a single child.

Membranes.—As to the arrangement of the fetal membranes, the decidua vera is invariably single; the decidua reflexa is double when the ova are attached to parts of the uterine wall widely separated. The chorion, since it takes its origin primarily from the zona pellucida, is single when the twins are derived from two nuclei within a single ovum, but double when they originate from separate ova. Originally the amnion is always double, for it is elaborated as an outgrowth extending from the embryo itself. When twins are in one common membrane, there has been, as noted before, an absorption of the septum which, for a time, served as a barrier (Figs. 184, 185, and 186).

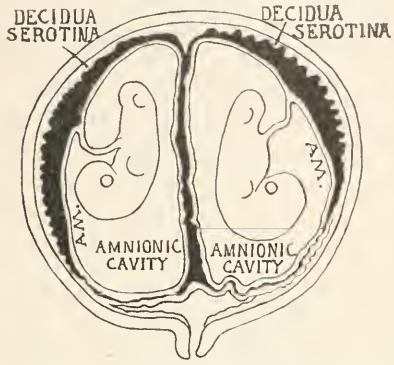

Fig. 184.—Twin Pregnancy Resulting from Two Ova from the Same or Different Graafian Follicles and from the Same or Opposite Ovaries. First arrangement of fetal structures. *A.M.*, Amnion. The heavy black portion indicates the chorion.—(*Dakin.*)

Placenta.—Primarily the placenta is double, for each fetus produces its own allantois and the placental region resulting therefrom. In the case of twins coming from different ova, the placenta may remain separate, but even in this case fusion of the placental areas finally occurs. There is almost without exception an anastomosis of the vessels of the placentæ of single-egged twins, consequently the placentæ are fused to a certain extent, and there results a common area of nutrition for both fetuses; while there are two other

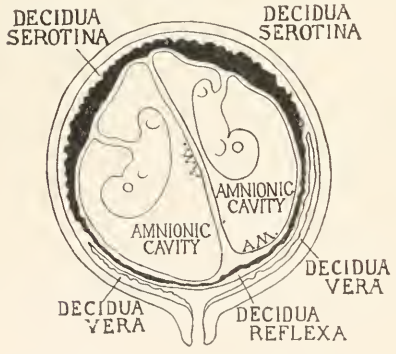

Fig. 185.—Twin Pregnancy from One Ovum with Two Germinal Spots. Second arrangement of fetal structures. *A.M.*, Amnion. The heavy black portion indicates the chorion.—(*Dakin.*)

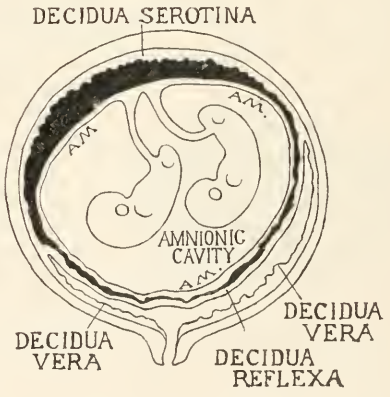

Fig. 186.—Twin Pregnancy from One Ovum with One Germinal Spot. Third arrangement of fetal structures. *A.M.*, Amnion. The heavy black portion indicates the chorion.—(*Dakin.*)

areas, one for the special use of each fetus (Hyrtl). Hence, if there are two distinct ova, there may be expected two sets of membranes, while in the case of one ovum with two nuclei, a double amnion but a single

chorion, and a single placenta will probably develop. Sometimes only one amnion is found, in which case the partition between the two has probably been dissolved. Veit found in 429 cases, that 383 were from two distinct ova, 46 from a single ovum, and two had a single amnion. Ahlfeld found a single amnion in 456 cases, or half as frequently as Veit. In a twin pregnancy with one placenta it is very necessary to tie the cord of the infant first born, for the second may bleed to death from the cord of the first.

Abnormal Conditions.—The circulation of one child may be more fully developed than that of the other, so that the second becomes a monster. There may be a marked amount of fluid in one sac and very little in the other (Ahlfeld). The anastomoses of the vessels of the placenta may exert a very strong influence on the development of the twins. Circulation from the weaker may be directed almost entirely to the stronger, and there will result, in the case of the first, fetal atrophy, or acardia. In case of the death of one fetus, the living child will, in its growth, compress the dead child more and more till it becomes a flattened mass pressed against one side of the uterine wall, and known as the "*fœtus papyraceus*"* (Fig. 445). There may be a striking difference between the infants at birth, the one being large and vigorous, the other small and puny. Now and then it happens that the larger child is born at term, and the immature fetus is retained till it has become more like its fellow, when it is likewise expelled. Cases of double uteri have been recorded in which two children of the same mother have been born a month or more apart (Barker, Generali).

Symptoms and Diagnosis.—Often there are no subjective symptoms to point to this interesting condition. Usually all the symptoms of pressure and congestion, and sometimes the reflex and sympathetic disturbances, are exaggerated. As a rule, the duration of pregnancy is shortened by about two weeks, by reason of the overdistention. The uncertain signs are: (1) exaggerated pressure and congestive symptoms; (2) excessive size and irregularity of the uterine tumor, with (3) increased tension of the uterine walls, and (4) diminished fetal mobility. The certain signs are: (1) the palpation of similar parts of the fetus, as two heads, two breeches, a number of fetal extremities, or after dilatation of the os, two bags of membranes. (2) The detection of two or three fetal heart sounds at different points of the abdomen, of the same degree or of different degrees of intensity, and separated by areas over which the sounds are absent or indistinctly heard. Errors in diagnosis are the result of depending too much on this sign; in the case of a uterus containing a large fetus, with little liquor amnii, and covered by thin maternal abdominal walls, the fetal heart may be heard more or less distinctly over the entire uterine surface, and unless two observers auscultate and count at the same time, differences in heart rate and intensity may appear to be present. I made this mistake early in my private practice; the child, a male, weighed 9½ pounds. (3) The detection, by bimanual palpation, of two fetal poles in the uterus. Thus, with two fingers in the vagina upon the presenting fetus, upon pushing this fetal pole upward, the hand upon the fundus will perceive an absence of motion in one fetal pole, and the conveyed impulse of the vaginal palpation in the other. This, in my experience, is the most reliable sign, as I have frequently demonstrated to students in the clinic.

Prognosis.—The dangers for the mother are: (1) greater liability to toxemia of pregnancy and eclampsia, on account of the increased metabolism of the two or

* See Amorphus anideus, Fig. 391.

more fetuses, and the greater pressure on the kidneys and ureters. My study of 31 cases of twins shows albuminuria almost constantly present. (2) Uterine inertia, prolonged labor, and post-partum hemorrhage are liable to occur as a result of the extreme uterine distention. (3) Abnormal presentations may be present as the result of irregularity in the shape of the uterine cavity. (4) Premature expulsion of the fetuses occurs in about 25 per cent., with greater tendency to placental retention. The fetal prognosis is affected by: (1) Deficient development of one or both twins; the stronger and better-developed twin attracts more nourishment, and crowds and perhaps kills its fellow (*fœtus papyraceus*); or lack of fetal movement results in poor muscular development of the extremities and bodies of both twins. (2) In unioval twins anastomosis between fetal and placental vessels is apt to produce monsters. (3) Hydramnios is frequent. (4) Complications of malpresentation and position may occur at the time of birth. Thus, (*a*) compound presentations, as double head, double breech, and head with breech, or breech with extremities; (*b*) malpresentations, as shoulder presentation of second child (10 per cent.); (*c*) coiling and twisting of the cords after the onset of labor; (*d*) locking and welding, an engagement and interlocking of both heads, locking of a head or breech with a shoulder presentation, interlocking of chins, interlocking of occiputs.*

Phenomena of Labor. See Part V.

VIII. THE DURATION OF PREGNANCY. PROTRACTED GESTATION.

Definition.—By the actual duration of pregnancy we understand the time that elapses between impregnation and labor. The duration we are unable to obtain in any case with exactness, since the date of conception is always unknown. The uncertainty is due to two facts: First, there may exist an interval of from one to fourteen days between the time of insemination and fertilization of the ovum; and, second, it is impossible to know in a given case whether the ovum which is fertilized is the product (1) of the last menstrual epoch, (2) of the intermenstrual period, (3) of, or the date corresponding with, the first suppressed period. The real duration of pregnancy, therefore, in the human female is an unknown quantity.

The Average Duration.—We learn from experience that the average apparent duration of pregnancy is ten lunar or nine calendar months, or forty weeks, or two hundred and eighty days from the beginning of the last menstrual period, or two hundred and seventy-two days from the date of conception. Schlichting† investigated 456 cases, and made the average to be 269.5 days; and yet the time varied from two hundred and forty to three hundred and thirty-four days. Winckel,‡ in his 5010 cases examined, found 70 in which the duration of gestation was more than three hundred days, and in 6.8 per cent. of those cases in which the exact date of impregnation was considered known, the duration was more than three hundred days; in one case the duration was three hundred and

* In 31 twin labors in hospital practice I found the maternal mortality 0 per cent. Both children lived in 24 cases, or 77.41 per cent., and one lived and one was still-born in 6, or 19.35 per cent. Labor was natural in 20 cases, or 64.51 per cent.; the forceps was required in 4 instances (once in eight cases); version in 4 and breech extraction in 1.

† "Arch. f. Gynäk.," Bd. xvi, 210.

‡ "Text-book of Midwifery," 1890, p. 94.

fourteen, and in another three hundred and eighteen days. Löwenhardt,* from 518 cases in which the women could give the date of the fruitful coitus, found that the average duration of pregnancy from the date of conception was 272.2 days. Leuckardt, from an analysis of 67 cases found upon the marriage and birth register of a church, in which labor occurred within ten months after the marriage night, computed the average duration of pregnancy to be 272.5 days. Hasler,† from a large number of cases in which the date of the impregnating coitus was known, estimated the average duration of pregnancy to be 272.24 days from the date of conception, and 280.5 days from the beginning of the last menstrual epoch. Issmer,‡ in an exhaustive paper upon the duration of pregnancy, based on a careful analysis of 464 cases, has given the following interesting conclusions: (1) Conceptions occurring in the first half of the intermenstrual period are to those in the second half as 72 to 27. (2) Pregnancies dated from the first half of the intermenstrual period are shorter in duration than those dated from the second half. (3) When impregnation occurs in the first half, the ovum fertilized is that which was discharged at the last menstruation (ovulation); while when it occurs in the second half, the ovum impregnated is one that escapes at or near the next menstrual period. (4) The average duration of pregnancy is two hundred and sixty-eight days from conception, or two hundred and seventy-eight days from the completion of the last menstruation. The maximum duration is three hundred and four days.

Authorities differ somewhat in giving the average duration of gestation in the human subject. Thus (calculated from the first day of the last menstruation): Schlichting § (440 cases) gives 273.1 days; Matthew Duncan‖ gives 278 days; Löwenhardt-Ahlfeld ¶ (166 cases) gives 281.6 days; Hasler (large number), 280.5 days. And, calculating from conception, Schlichting,** 456 cases, gives 269.5 days; Löwenhardt,†† 518 cases, gives 272.5 days; Leuckardt,‡‡ 67 cases, gives 272.5 days; Hasler,§§ large number, gives 272.24 days.

Protracted Gestation.—A case is reported by Thomson‖‖ in which gestation lasted 317 days from the last menstrual period, or 301 from the last sexual intercourse. Krüche ¶¶ reported a case in which he believed the duration of pregnancy was 330 days. The latest period to which pregnancy may be protracted is stated by various authors as follows: Depaul, 300 days (high limit); Robert Barnes, 300 days (improbable); Issmer,*** 304 days; Winckel,††† 320 days; Schröder,‡‡‡ 320 days; Schlichting,§§§ 334 days; Runge,‖‖‖ 320 days.

Reese ¶¶¶ states that it is possible for pregnancy to be prolonged beyond the usual period accepted as the average, but he gives no limit.

As to the legitimacy of offspring according to the duration of pregnancy, different countries possess different laws. In Austria **** the law recognizes the legitimacy of the child born within 240 to 307 days after the death of the father. In France†††† "the legitimacy of the infant born 300 days after the dissolution of the marriage is liable to be contested." In England and America "the light of the courts in this matter is reflected light. Physicians must determine the matter; and if the space between the minimum and maximum periods hitherto allowed is shown to be too long or too short, the courts will readily follow the truth as it is made manifest." In Wharton "On Evidence" (sec. 1, 300) we find no absolute limit laid down. Each case is determined upon its merits. A liberal view is taken, and the legitimacy of births at the completion of 313 and 317 days respectively has been judicially decided. This limit of 317 days is, according to most medical authorities on the subject, an extreme one.

* "Arch. f. Gynäk.," III, 1782.
† "Ueber die Dauer der Schwangerschaft," Zurich, 1876.
‡ "Arch. f. Gynäk.," XXXV, 1889, p. 310.
§ "Arch. f. Gynäk.," Bd. XVI, 210.
‖ Ibid., Bd. III, 456.
¶ "Monat. f. Geburtsh.," XXXIV, 180, S. 266.
** Loc. cit.
†† Loc. cit.
‡‡ Loc. cit.
§§ Loc. cit.
‖‖‖ "Trans. London Obstet. Soc.," vol. XXVII.
¶¶ "Deutsche med. Zeitung," von Grosser, 1883, 370.
*** "Arch. f. Gynäk.," Bd. XVI, 210.
††† "Text-book of Midwifery," 1890, p. 94.
‡‡‡ "Lehrb. der Geburtsh.," 9te. Aufl., Bonn, 1886, p. 109.
§§§ "Arch. f. Gynäk.," Bd. XVI, 210.
‖‖‖ "Lehrb. d. Geburtshülfe," Berlin, 1891.
¶¶¶ "Text-book of Med. Jur. and Tox.," Phila., 1889.
**** "Das k. k. Oesterreichische bürgerliche Gesetzbuch," "Amer. Sys. Obstet.," vol. I.
†††† L'article 315 du code civil.

IX. CALCULATING THE DATE OF CONFINEMENT.

1. When the Date of a Single Cohabitation is Known.—Add 280 days, or (Naegele's rule) count back three months from the date of cohabitation, and add seven days for impregnation. In leap years, after February 6th, the number of days to be added varies according to the month; *e. g.*, in February, four days; in December and January, five days; in April and September, six days.

2. When the Date of the Last Menstruation is Depended Upon.—(1) Count back three months from the appearance of the last menstruation, and add ten days, three for menstruation and seven for impregnation. The first day of the last menstruation is a date far more readily obtained than the date of cessation, and is the best time to count from. (2) *Duncan's rule:* Add to the last day of the last menstruation, nine months, which should be counted as 275 days, unless February be one of the months, in which case the period will be 273 days. To the date thus obtained, add three days in the former case, and five in the latter, which will make 278 days. This two hundred and seventy-eighth day will be the middle of the fortnight in which labor will be apt to take place. (3) *Löwenhardt's method:* Reckoning is made of the number of days between the last menstrual epoch and the one preceding that. This result, multiplied by 10, will represent ten menstrual periods, and will be very accurate.

3. When the Date of the Last Menstruation is Unknown.—If a woman becomes pregnant when she is not menstruating,—in lactation, for example,—or when from any other reason the date of the last menstruation cannot be ascertained, some method must be employed which does not take this into account; such as (1) counting from the date of quickening; (2) height of the fundus; (3) mensuration of the fetus *in utero;* (4) time of lightening; (5) changes in the cervix. (1) *From date of quickening:* Count from the first appearance of the "quickening," which, on the average, appears at the seventeenth week. To this date is added four and one-half months, in order to estimate roughly the date of confinement. (2) *From the height of the fundus* an approximate idea may be obtained; fourth month, the fundus occupies the hypogastrium; fifth month, midway between symphysis and umbilicus; sixth month, on a level with the umbilicus or just above; seventh month, midway between the umbilicus and xiphoid cartilage; eighth month, at xiphoid cartilage; ninth month, descends almost to depth at which it was in seventh month, the presenting part having entered the pelvic brim in primigravidæ. On account of the variations in the position of the umbilicus, Spiegelberg estimated the height of the fundus above the symphysis in the different weeks of pregnancy. His results are appended:

From 22d to 26th week	fundus of uterus			8.56	inches	(20.0 cm.)	above	symphysis.
At the 28th	"	"	"	10.43	"	(25.0 cm.)	"	"
" 30th	"	"	"	11.02	"	(27.5 cm.)	"	"
" 32d–33d	"	"	"	11.81	"	(29.0 cm.)	"	"
" 34th	"	"	"	12.00	"	(30.0 cm.)	"	"
" 35th–36th	"	"	"	12.50	"	(31.5 cm.)	"	"
" 37th–38th	"	"	"	12.99	"	(33.0 cm.)	"	"
" 39th–40th	"	"	"	13.39	"	(34.5 cm.)	"	"

(3) *By measurement of the fetal ellipse:* On account of the variations in individual pelves, and the importance in contracted pelves of the size of the fetus, Ahlfeld has paid much attention to the measurement of the child *in utero.* The fetal ellipse in the last months of pregnancy is nearly half the length of the fetus; *i. e.*, the length of the long axis of the fetus, as it lies flexed in the uterus, is about

half the length of the extended fetus (Fig. 187). These measurements are taken by means of calipers, one end of which is rested against the presenting part in the vagina, and the other against that part of the fetus in the fundus of the uterus. Thus, whenever a measurement is taken of the fetal ellipse, it will represent half the length of the fetus at that particular date. The table below gives the corresponding length of the fetal ellipse, of the extended fetus, and its weight at various weeks of its growth. This method is used when the fetus presents longitudinally. When the presentation is transverse, the measurement is purely abdominal. (4) The phenomenon of *lightening* at the beginning of the preparatory stage to labor, although its value in foretelling the day of delivery is not great. (5) *Changes in the portio vaginalis and cervical canal* in the latter part of pregnancy, especially in primigravidæ, should be taken into consideration.

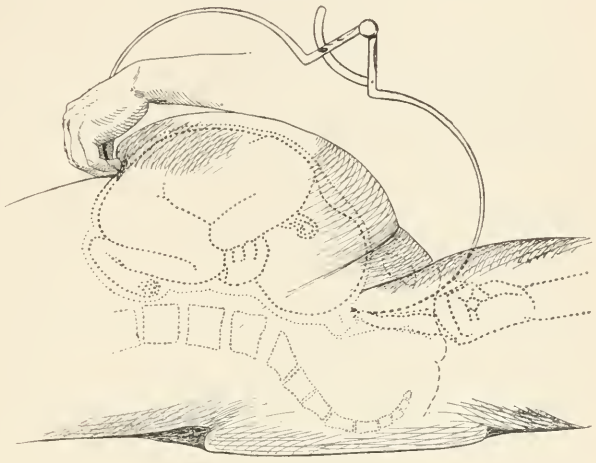

FIG. 187.—CALCULATING THE DATE OF THE EXPECTED CONFINEMENT BY MEASURING THE FETAL OVOID WITH ONE POINT OF THE PELVIMETER ON THE FETAL HEAD IN THE VAGINA, AND THE OTHER ON THE BREECH THROUGH THE ANTERIOR ABDOMINAL WALL.

PERIOD OF PREGNANCY.	AXIS OF FETAL ELLIPSE.	TOTAL LENGTH OF FETUS.	WEIGHT OF FETUS.
At the 20th week	3.82 to 5.79 in. (9.7 to 14.7 cm.)	7.08 to 10.62 in. (18 to 27 cm.)	9.8 oz. (280 grams)
" 24th "	5.90 to 7.36 in. (15.0 to 18.7 cm.)	11.02 to 13.48 in. (28 to 34 cm.)	1.395 lbs. (634 grams)
" 28th "	7.08 to 8.97 in. (18.0 to 22.8 cm.)	13.88 to 14.96 in. (35 to 38 cm.)	2.64 lbs. (1200 grams)
" 32d "	9.45 to 10.82 in. (24.0 to 27.5 cm.)	14.96 to 16.93 in. (38 to 43 cm.)	3.52 to 4.18 lbs. (1600 to 1900 grams)
" 36th "	10.63 to 11.81 in. (27.0 to 30.9 cm.)	16.52 to 18.90 in. (42 to 48 cm.)	3.74 to 5.72 lbs. (1700 to 2600 grams)
" 40th "	11.81 to 14.56 in. (30.0 to 37.0 cm.)	18.90 to 20.47 in. (48 to 52 cm.)	6.60 to 7.92 lbs. (3000 to 3600 grams)

The exact day of delivery probably depends on small details, either mental or physical. Impregnation has been observed to occur at any time in the menstrual month, although considered to take place more frequently in the few days just preceding, and those immediately following, menstruation. Some women always seem to exceed the normal limits of pregnancy, and in such cases the child is usually a large-sized male. In other cases the duration of pregnancy is shorter than usual; it is said to be so, early and late in the reproductive age, and in single women, while it is long in the middle part of the child-bearing period. It is quite likely that the gestation period corresponds with the length of the individual's menstrual cycle. If fecundation takes place a few days after the close of a menstrual period, the next menstrual period is almost invariably suppressed. If, however, it occurs a few days before a menstrual

epoch, then there may be an irregular or atypical menstruation succeeding. In the case of a woman with an irregular menstrual history the difficulties of calculation increase.

X. THE EXAMINATION OF PREGNANCY.

No better time than that of the examination of pregnancy can be selected for inculcating in the student the principles of obstetrical cleanliness, mechanical and chemical. The principles of personal cleanliness and disinfection, if not learned now, are less likely to be acquired afterwards. While it cannot be stated that the same danger attends vaginal examinations in pregnancy as in labor, still, in the latter part of pregnancy, the examining finger often enters the cervical canal, and in the one or more weeks of the preparatory stage of labor the conditions are often quite analogous to active labor. Moreover, the possibility of a low placental attachment, or even of actual labor, must always be granted. For these reasons obstetric asepsis demands that the same rigid cleansing of the hands and forearms, and precautions in separation of the sides of vulva, be applied to the examination of pregnancy, as to that of labor and the puerperium.

Obstetric Asepsis.—In Vienna, in 1847, the foundation of aseptic midwifery was laid by Semmelweis, and perfected by others along the lines laid down by Pasteur and Lister. Semmelweis, in 1847, discovered the septic nature of puerperal fever, and by means of chlorine solutions instituted an antiseptic prophylaxis against the scourge. In brief, puerperal fever was, according to Semmelweis, no new specific disease, but a variety of pyemia.

At the beginning of the present century the consensus of opinion was that the pregnant vagina and gravid and puerperal uterine cavity were quite sterile under normal conditions, and that autoinfection from these sources was quite impossible except in rare instances. In other words, septicemia was in the vast majority of cases a disease introduced from without. The evidence upon which this view rested, including the result of the labors of Bumm, Krönig, and others, was thought to be irrefutable. Of course, theories were not wanting to explain this supposed sterility of the birth-tract, and the chief of them had reference to the bactericidal power of the vaginal secretion and lochia,* each of which was pronounced to be not only a poor culture-medium, but, moreover, endowed with powers of self-purification, even after the introduction of an abundance of germ-life. This theory was in excellent accord with practice, for it inculcated the greatest thoroughness in obstetric asepsis and made the practitioner practically responsible for the occurrence of an aseptic puerperium. From this point of view I trust the profession will never recede, but as a matter of fact the views thus held as a scientific gospel have within the past few years been completely undermined by new discoveries. An increasing number of observers have found that the healthy vagina of the pregnant woman is by no means always sterile; and that streptococci pathogenic to animals may be recovered from not a small proportion of cases. Two of the most recent authorities, von Rosthorn † and Lenhartz,‡ accept the view that the vagina is not sterile, and possesses no inherent bactericidal power. At the

* As will be seen later, the lochia does possess such powers, although they are hardly in force directly after delivery.

† von Winckel: "Handbuch d. Gebürtshulfe," Bd. 1, 1903.

‡ "Die septische Erkrankungen," 1903.

same time, Franz,* Schauenstein,† Wormser,‡ and others have shown that ordinary saprophytes and streptococci invade the uterine cavity immediately after labor in a very large number of cases. Walthard § claims that vaginal germs at times readily pass into the non-pregnant uterus, where they may set up endometritis and toxemia. The locomotive powers of virulent streptococci in cultures is of course well known; for example, according to Bumm,‖ these germs, after having inoculated birth-traumas in the vulval region, can migrate into and infect the endometrium in twenty-four hours, while the rapid decomposition of retained decidual and placental structures shows that saprophytes, whatever their source, have ready access to the puerperal uterus. Sepsis of grave character occurs not rarely in women who have never been submitted to the examination of pregnancy and in those who have been examined with sterilized gloves.

According to the older views, the external genitals alone abounded in germ life, and much of the puerperal morbidity could be attributed to the accidental transportation of these germs into the vagina by the examining finger, and by manipulation on the part of the patient.

I found that the secretion in the vulval canal, in twenty-eight pregnant and two parturient women in the Emergency and Maternity Hospitals, showed pyogenic bacteria in forty per cent. of the cases: Staphylococcus pyogenes albus in 8 cases, Staphylococcus pyogenes aureus in 3 cases, and Streptococcus pyogenes in one case. In all but two of the cases the external genitals were washed with soap and water just previous to the taking of the cultures.¶

Vaginal Examinations and Manipulations.—We may accept the following statement as probable: The microbes which are known to cause puerperal morbidity may or may not be present in the healthy vagina. From the very large proportion of cases in which they invade the uterus immediately after labor the chances are that the majority of vaginas contain germs. These, while comprising even Streptococcus pyogenes in a goodly proportion of cases, must not straightway be regarded as pathogenic; they may or may not be so. The question must arise, "If we believe that the vagina in a very large proportion of cases contains germs which are almost certain to pass into the uterus after delivery, and which while not necessarily or ordinarily pathogenic may still be the cause of severe and even fatal sepsis under certain circumstances, should we return to the old custom of antiseptic douching of the vagina as a routine practice?" At present this question, it must be confessed, is by no means easy to answer offhand. Such antisepsis is still practised as a procedure of necessity in selected cases, as in suspected gonorrhea, before manual or operative delivery, etc. (See Part X.) We have no means of differentiating between sterile and non-sterile vaginal secretions, for Döderlein's distinction between normal and pathological secretions—the latter having an alkaline reaction and excess of formed elements—has little practical value. We know in advance that the majority of cases in the absence of vaginal antisepsis will go through the puerperium without morbidity. We may also feel fairly positive that a certain proportion of women will in the long run undergo more or less severe sepsis, with secondary morbidity, and perhaps some fatalities. But

* Franz: "Hegar's Beitrage z. Gebürtshulfe," 1902, VI. † Cited by Franz, *v. supra.*
‡ Ibid. § Walthard: "Zeitschr. f. Gebürts. u. Gyn.," 1902, XLVII.
‖ "Grundriss zum Studium des Geburtshülfe," 1902, p. 655.
¶ See author's experiments on 13 primigravidæ and 17 multigravidæ at Emergency and New York Maternity Hospitals. "Asepsis in Obstetrics," "New York Medical Record," Feb. 11, 1899, vol. LV, p. 193.

should douching really reduce morbidity? When vaginal antisepsis was practised as a routine procedure, it was asserted that the upper vagina could not be rendered sterile. I can at present see but one way in which this question can be answered. If some of the experimenters who have developed the technique for obtaining the lochial secretion from the puerperal uterus will submit a large series of cases to antiseptic vaginal douching before delivery, and will then investigate the bacteriology of the uterine cavity on the various puerperal days, we might gather some notion of the efficacy of vaginal antisepsis.

Another method of some value might be the taking of rectal temperature, as is Bumm's * custom, with a view of detecting febriculæ from slight sapræmia, the woman having previously been subjected to vaginal antisepsis. If thirty per cent. to sixty per cent. of the cases showing elevation of temperature (100.4° F. in the rectum) should show a marked reduction, we might well conclude that vaginal douching should be practised.

Hofmeier (Würzburg) † has repeatedly asserted the value of routine prophylactic antepartum douching, and credit must certainly be given him for securing the smallest morbidity and mortality of any maternity in Germany. This obstetrician has had but four deaths in his last 6000 deliveries—a mortality of but 0.06 per cent. It should be added that the general hygienic conditions at Hofmeier's clinic are by no means favorable, and that his cases are examined by a very large number of students, candidates for state examinations and by midwives. Sublimate is used as an antiseptic.

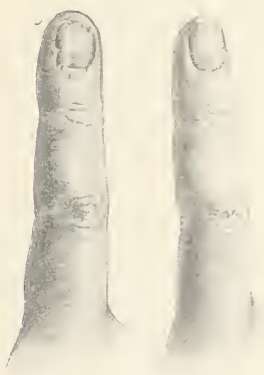

Fig. 188.—The Left-hand Finger shows an Exaggeration of a Badly Groomed Finger-nail and Cuticle which Would Favor Sepsis from the Lodgment of Septic Material. The Right-hand Finger shows a Properly Kept Nail and Cuticle.

Lenhartz ‡ states that of forty deaths from puerperal infection at the Eppendorfer Krankenhaus, Hamburg, no less than twenty-two occurred after normal spontaneous labor. It seems a reasonable supposition that antepartum douching would have saved many of these women. Lenhartz recommends prophylactic douching with sublimate (1 : 4000) or lysol (two per cent.).

Preparation of the Patient.—When feasible the bladder and rectum should be emptied, the external genitals scrubbed with soap and water with a soft brush or cotton, the whole, including the vulval canal, rinsed with plain water, and then cleansed or irrigated with 1 : 2000 or 1 : 4000 sublimate solution, from above downward.

Preparation of Physician.—Care of the Finger-nails.—Ragged, unclean, badly groomed finger-nails are inexcusable in the obstetrician, and certainly predispose to sepsis, since they cannot readily be rendered aseptic (Fig. 188). With a few minutes' attention each morning, one can keep his finger-nails in good condition. The shape of the nail is largely a matter of individual taste, but for aseptic purposes a nail with rounded point will best serve the obstetrician's purpose, provided that at the rounded point the nail is not more than $\frac{1}{16}$ inch (0.15 cm.) in length.

Disinfection of the Hands.—The foundation of the aseptic method in

* Bumm: "Zeitschr. f. Medizinal-beamte," April 1, 1903.

† Hofmeier: "Münch. med. Wochen.," 1902, Nos. 18, 19.

‡ Lenhartz: "Die septisch. Erkrankungen," Wien, 1903.

obstetrics rests upon sterilization of the hands, which may be accomplished in one of several ways. It must be remembered that when we refer to the hand we include as well the forearm to the elbow, which in all cases, especially in labor and operative obstetrics, should receive the same conscientious cleansing as the hand and fingers. To this end the coat should be removed and the sleeves rolled up before the cleansing process begins. Women physicians should have the sleeves of both arms so made as readily to permit of being rolled back to the elbow. All methods of disinfection should be preceded by thorough and prolonged scrubbing with a hand-brush in soap and hot water, particular attention being given to the spaces under and around the nails, which are to be kept short and smooth. About five minutes should be employed in the scrubbing process, which is to be followed by some form of chemical antiseptic treatment.

FIG. 189.—FLATTENED END OF AN ORANGE STICK USED TO PUSH BACK THE CUTICLE FROM THE NAIL.

FIG. 190.—EDGE OF A TOWEL USED FOR CLEANING AND POLISHING THE INNER SURFACE OF THE FINGER-NAIL.

RUBBER GLOVES.—I cannot too strongly urge the use of sterile rubber gloves, as a routine measure in confinement cases. No ordinary obstetrician, namely, the so-called general practitioner, and no physician, surgeon or obstetrician, who is at all doubtful concerning his personal asepsis, is justified in attending women in confinement without utilizing this simple and effective precaution.

FIG. 191.—HAND ENCLOSED IN RUBBER GLOVE.

CHEMICAL ANTISEPTICS.—The most generally employed chemical antiseptics are carbolic acid and bichloride or biniodide of mercury. A very large number of other chemicals have been suggested and used more or less, but few of them have any qualities which will enable them to displace the sub-

stances first mentioned. Among those which have from time to time proved useful may be enumerated permanganate of potash, oxalic acid, chlorinated lime and carbonate of soda, alcohol, creolin, lysol, and hydrogen peroxide. Creolin is not often used at present, but lysol, in a two per cent. solution, is employed to some extent as a vaginal douche before labor, when there is reason to believe that there is infection present in the vagina, and also as a solution for instruments. It is objectionable for the latter use because it makes the instruments slippery, while this lubricating quality is somewhat useful when employed in the vagina. Bichloride of mercury is used in solution for various purposes in strengths of 1 : 500 to 1 : 10,000, and the same is true of the biniodide. The tablets which are extensively sold are very convenient and accurate in making solutions of these chemicals, and they have the additional advantage that substances are combined with them which prevent the solutions becoming inert as a result of the affinity of the mercuric salt for albuminous bodies. Carbolic acid is used in watery solutions, to which a little glycerin has been added. The strength varies from 1 : 20 to 1 : 100. After the preliminary scrubbing one of the following antiseptic methods should be employed:

FIG. 192.—OPENED VULVA IN A PRIMIGRAVIDA, AGED TWENTY-TWO; THIRTIETH WEEK OF PREGNANCY; DEEP VULVAL CANAL.—(*From a photograph at the New York Maternity.*)

1. The scrubbed hands and forearms are (1) rinsed in sterile water; (2) immersed for half a minute in alcohol of at least 80 per cent. strength; and (3) then in a 1 : 1000 or 1 : 2000 solution of bichloride or biniodide of mercury, for from three to five minutes. A scrubbing-brush may also be used with advantage in these solutions, to assist in causing the antiseptic to penetrate.

2. After scrubbing, the hands and forearms are (1) immersed in a saturated solution of potassium permanganate until they are stained a deep mahogany brown; (2) they are then transferred to a saturated solution of oxalic acid, and kept immersed until decolorized. (3) After this they are rinsed in sterile water or salt solution. This method is very efficient. Some writers advise washing for three minutes in a 1 : 500 bichloride of mercury solution, as an additional precaution after the oxalic acid is washed off (Halsted, 1899).

3. (1) A paste is made by mixing water with chlorinated lime; the hands are rubbed thoroughly with this, and (2) meanwhile a lump of sodium carbonate is picked up and rubbed in with the mixture, until a sensation of coolness is felt. (3) A hand-brush is now used with the solution for several minutes, and (4) the hands washed in sterile water and then in (5) alcohol or weak ammonia

water. The last two methods are very efficient and are commonly used by surgeons in operating, but even after these precautions cultures from the deeper layers of the skin will sometimes grow. After the sterilization of the hands is complete, the obstetrician must see to it that they are not again contaminated by coming in contact with anything which has not been sterilized, between the antiseptic solution and the vagina.

Sterilized rubber gloves will be found useful in obstetrical practice for making examinations, especially when the hands have recently had to do with septic cases, or when the means for a chemical sterilization are not at hand. The rubber gloves can be sterilized by boiling (Fig. 191). If a lubricant is necessary, and it rarely is, it should be vaseline or glycerin which has been heated for five or ten minutes to 212° F. and kept afterward in a sterilized vessel.

Objects of the Examination.—In the examination of pregnancy (1) the actual existence of pregnancy should be determined, as well as (2) the period of gestation; (3) the probable date of labor; (4) the viability of the fetus; (5) the diagnosis of the presentation, position, and engagement of the head; (6) the condition of the patient's genital organs, including the breasts; (7) the size of her pelvis; and (8) the obstetric prognosis. It is advisable also at this time to inquire and record (see chart, Appendix) (1) the date and type of the last menstruation; (2) her family and personal history, including degree of parity; (3) the character of her previous pregnancies, labors, and puerperiums. Her nurse or nurses should also be arranged for, and directions given regarding the hygiene of pregnancy and the procuring of the mother's, baby's, and obstetric outfit. (See Part IV.) Primigravidæ should have their pelves measured before the twenty-eighth week; the spines, crests, trochanters, external and internal conjugates, being measured as matters of routine. Should pelvic deformity exist, more exhaustive measurements should be taken, and if necessary we should not hesitate to make an internal examination under nitrous oxide, chloroform, or ether. A comparison should be made between these measurements and the weight and height of the patient, and her husband, and their ages. The patient's skeleton should be considered as to its character; one composed of light bones has generally a relatively large pelvic girth, while the converse also holds true. If the patient be a multigravida, all of these careful measurements are not necessary in private practice, if the previous children have been of usual size and the labors uneventful. However, the size of the fetal head

FIG. 193.—OPENED VULVA IN A PRIMIGRAVIDA; THIRTY-EIGHTH WEEK; SHALLOW VULVAL CANAL.—(*From a photograph at the New York Maternity.*)

should be estimated two weeks before labor is expected, in order to detect any overgrowth of the fetus. (See Cephalometry.) The examination of pregnancy can conveniently be divided into (1) external or abdominal, and (2) internal or vaginal.

EXTERNAL OR ABDOMINAL EXAMINATION. DIAGNOSIS OF FETAL PRESENTATION, POSITION, AND ENGAGEMENT OF PRESENTING PART. EXTERNAL PELVIMETRY.

The patient should lie upon her back upon the side of the bed or couch, with the clothing loosened and the abdomen bare, or covered only with one thickness of a bed-sheet, through which it is possible to make a satisfactory examination. The examiner should see that his hands are warm, since the

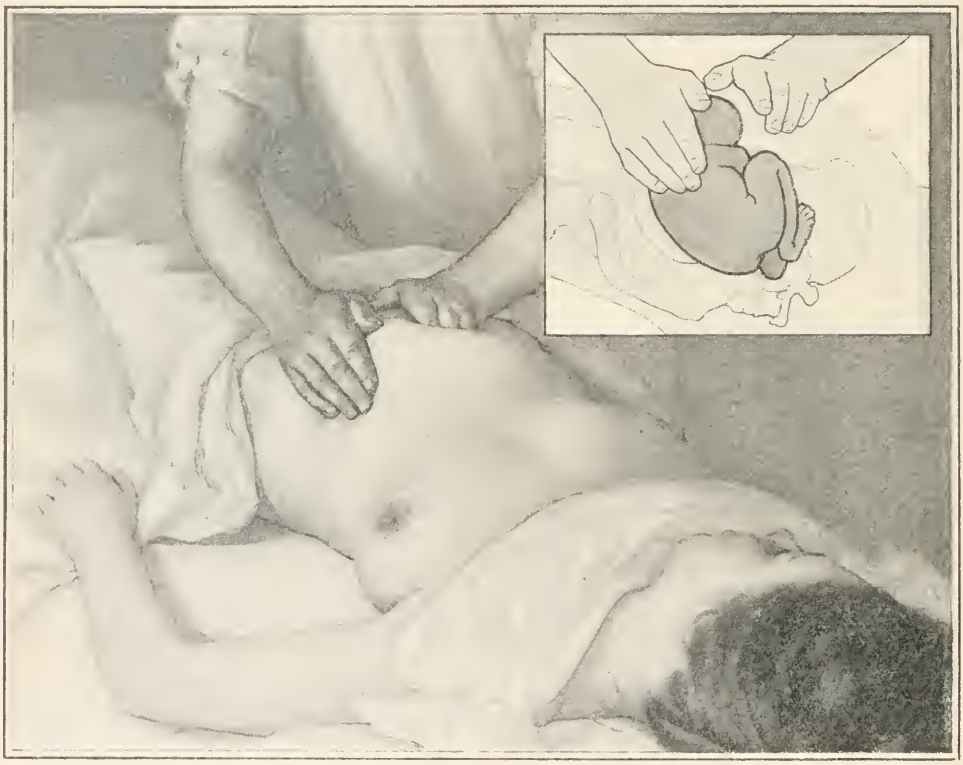

FIG. 194.—LOCATION OF THE FETAL BACK AND SMALL PARTS BY EXTERNAL PALPATION. The left hand displaces the fetus to the left for locating the dorsal plane.—(*From a photograph taken at the Emergency Hospital.*)

contact of a cold hand with the abdominal wall is apt to excite reflex contractions of the abdominal muscles, and even in the uterus. Moderate flexion of the thighs will often assist in relaxing the abdominal muscles, and this position can often be used to advantage. The bladder and rectum should have been emptied recently. We should ascertain as much as possible at the first examination, and, in order that nothing be overlooked, we ought to follow some definite routine order of examination, as in the case of the internal examination

of pregnancy (see page 167) and labor (see Labor). We should also accustom ourselves to palpate with the left as well as the right hand. The order of examination here recommended is: (1) Determination of general conditions. (2) Location of fetal back and small parts. (3) Palpation of the lower fetal pole. (4) Palpation of the upper fetal pole. (5) Location of the cephalic prominence. (6) Deep pelvic palpation. (7) Locating anterior shoulder. (8) Palpation in breech presentation. (9) Palpation in shoulder presentation. (10) Location of the fetal heart. (11) External pelvimetry. Most of the methods of abdominal palpation can be carried out while the examiner sits at the bedside, facing the patient's abdomen.

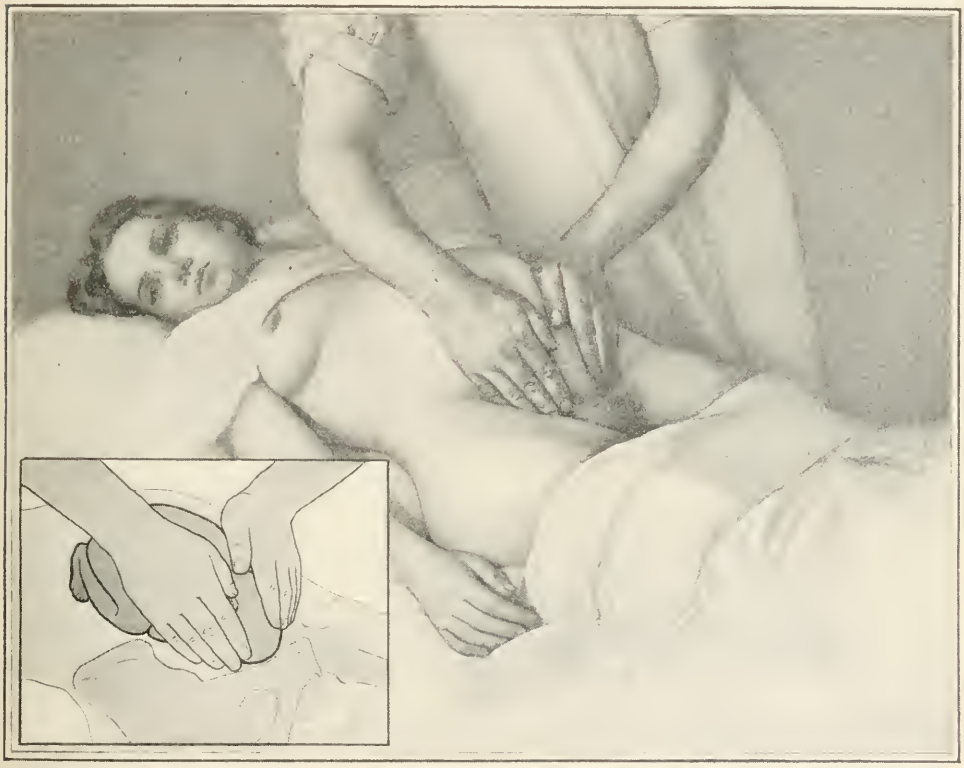

FIG. 195.—PALPATING THE LOWER FETAL POLE BY EXTERNAL PALPATION.—(*From a photograph taken at the Emergency Hospital.*)

1. General Conditions.—(1) The *general condition* of the patient should first be observed, and evidences of blood changes, pulmonary, cardiac, renal, syphilitic, or tuberculous disease noted; (2) the *breasts* and nipples are to be inspected for lacteal capacity and evidences of previous inflammation in the former, and for flatness, inversion, fissure, or erosion of the latter. We pass next to the *abdomen* and determine (3) the direction of the *uterine axis*, detecting any excessive right or left lateral obliquity or other displacement, the result of previous inflammations or operation, and (4) the thickness and pendulous condition of the *abdominal walls*. We should then determine by abdominal palpation the general shape and size of the uterus; the relation of the fundus to the umbilicus and ensiform cartilage; the size of the fetus, and its relation

to the amount of liquor amnii, and whether the fetus lies vertically, transversely, or obliquely in the uterus. This is accomplished by placing the palms of the hands one on each side of the abdomen, and sliding them evenly and gently upward and downward over the entire pregnant uterus, from the fundus to the pubis and back again to the fundus, at the same time, gently and without much pressure, palpating the whole maternal abdomen with the finger-tips (Figs. 195 to 201).

2. Location of Fetal Back and Small Parts.—The next point to be made out is the location of the child's back; this can usually be done by palpating the whole maternal abdomen with the tips of the fingers, gently and without

FIG. 196.—PALPATING THE UPPER FETAL POLE BY EXTERNAL PALPATION.—(*From a photograph taken at the Emergency Hospital.*)

much pressure. Stronger pressure may be necessary to ascertain the amount of resistance, mobility, etc., but it should be remembered that strong pressure blunts the tactile sensibility of the ends of the fingers. The small parts by this method will be felt as small rounded knobs, more or less movable. If the examiner will steady the fetus in its long axis, and exert some pressure upon the upper pole, the dorsal convexity will be considerably increased, and therefore more easily palpated. Another method is to apply moderate deep pressure with the palm of the hand on the middle of the abdomen. This displaces the fetus toward the side to which its back is turned, and while the pressure is maintained with one hand the examination may be made satisfactorily with the other (Fig. 195). In order to make out whether the back of the fetus is turned

toward the back or front of the mother, it is to be remembered that the fetal back offers a broad, smooth convex surface from end to end, while the lateral aspect is not convex from end to end, is narrower, and has a deep sulcus between head and pelvis. The small parts on one side indicate that the back is on the other, except in the case of twins. If small parts can be felt beyond either end of the fetus, the presentation is pretty certainly a breech. Certain conditions may, when present, make this part of the examination difficult or uncertain. A large amount of abdominal fat, hydramnios, and a rigidly contracted uterus, are some of these conditions.

3. Palpation of the Lower Fetal Pole.—The hands of the examiner are placed

FIG. 197.—LOCATING THE CEPHALIC PROMINENCE IN VERTEX PRESENTATION BY EXTERNAL PALPATION.—(*From a photograph taken at the Emergency Hospital.*)

flat upon the sides of the abdomen, with the palms toward each other, and the fingers toward the feet of the patient, and resting a little above Poupart's ligament (Fig. 195). When the hands are passed toward each other and also toward the cavity of the maternal pelvis, it is usually possible to catch quickly the fetal pole, and to manipulate it. The first point to determine, when the pole is found, is whether it is head or breech. The head is large, hard, and globular, and separated from the trunk by the constriction of the neck; and it is, furthermore, the only part of the fetus which sinks into the maternal pelvis before labor. The breech always lies above the excavation of the pelvis until labor begins. When either fetal pole is found in an iliac fossa, the presentation will be transverse.

4. Palpation of the Upper Fetal Pole.—To accomplish this satisfactorily, the position of the hands is in the opposite direction from that just described, the palms being placed facing each other on the upper part of the abdomen, with the fingers toward the patient's head (Fig. 196). The head when found in the upper segment of the uterus can be subjected to ballottement, and otherwise has the characteristics which have been mentioned (Fig. 200). The breech in the upper segment is less mobile, more voluminous, and softer than the head (Fig. 196).

5. Location of the Cephalic Prominence.—(1) The hand is pressed transversely across the maternal abdomen, just above the symphysis, and the head

FIG. 198.—DEEP PELVIC PALPATION TO DETERMINE THE AMOUNT OF ENGAGEMENT OF THE PRESENTING PART BY EXTERNAL PALPATION.—(*From a photograph taken at the Emergency Hospital.*)

thus grasped and palpated (Fig. 197). The occipital side is that at which the hand sinks deepest into the pelvis; since the occiput itself is the part of the head which, as a rule, is deepest in this cavity. The greatest prominence at the brim is, therefore, the forehead, most marked in the occipito-posterior position. (2) The right or left hand, with thumb and fingers separated as far as possible, grasps the fetal head just above the pelvic inlet (Fig. 197). Since the head in primigravidæ is usually partially engaged in the pelvic inlet, it is advisable to direct the thumb and finger-tips downward toward the pelvic cavity. In multigravidæ, by reason of the rather high situation of the head, the thumb and finger-tips are held more horizontally. In the latter case we

can assist in the manœuver by steadying the fundus with the disengaged hand. The head feels hard and ball-like and can usually be moved from side to side. The breech appears soft and irregular. In pelvic presentation the same method can be applied to the head lying in the fundus (Fig. 197). In shoulder presentation, no definite presenting part being found at the pelvic inlet, the head is sought for by gently palpating with short finger-strokes in one or the other side of the uterus (Fig. 201). It can then be grasped in the same manner as above, and the manœuver assisted by steadying the breech with the disengaged hand.

6. Deep Pelvic Palpation.—In primigravidæ when the head is engaged in the pelvis, and in both primiparæ and multiparæ when the same condition

FIG. 199.—LOCATING THE ANTERIOR SHOULDER BY EXTERNAL PALPATION. Right hand depresses and raises fundus, while the left palpates for the shoulder.—(*From a photograph taken at the Emergency Hospital.*)

obtains, the method of palpating the cephalic extremity shown in Fig. 198 is most useful, especially during labor. Moderate flexion of the thighs, approximation of the heels, and separation of the knees greatly assists in relaxing the anterior abdominal walls. As pictured in Fig. 198, the examiner stands at the side of the bed, facing the patient's feet. The palms of the hands are placed on both sides of the lower uterine segment, and the finger-tips of both hands are made to enter the pelvic cavity slowly and gently, alongside of the head, between it and the pelvic walls. As in Fig. 197, but more satisfactorily, the head when engaged in the pelvis can be felt as a hard, oval body occupying the latter; the more prominent forehead, on one side, being readily

distinguished from the less prominent occiput, or nape of the neck, on the other. The forehead is especially prominent in occiput posterior positions (Fig. 198). We have no more valuable method of determining bregma, brow, and face presentations before dilatation of the os, than that by deep pelvic palpation. In bregma presentation incomplete flexions of the occiput and forehead are about equally prominent; in brow presentations the occiput is more in evidence, while in face presentations it is the most prominent part of the fetal head to be palpated.

7. Location of the Anterior Shoulder.—One hand is placed above the uterus upon the fundus, so as to steady the organ and press it into the pelvis. With

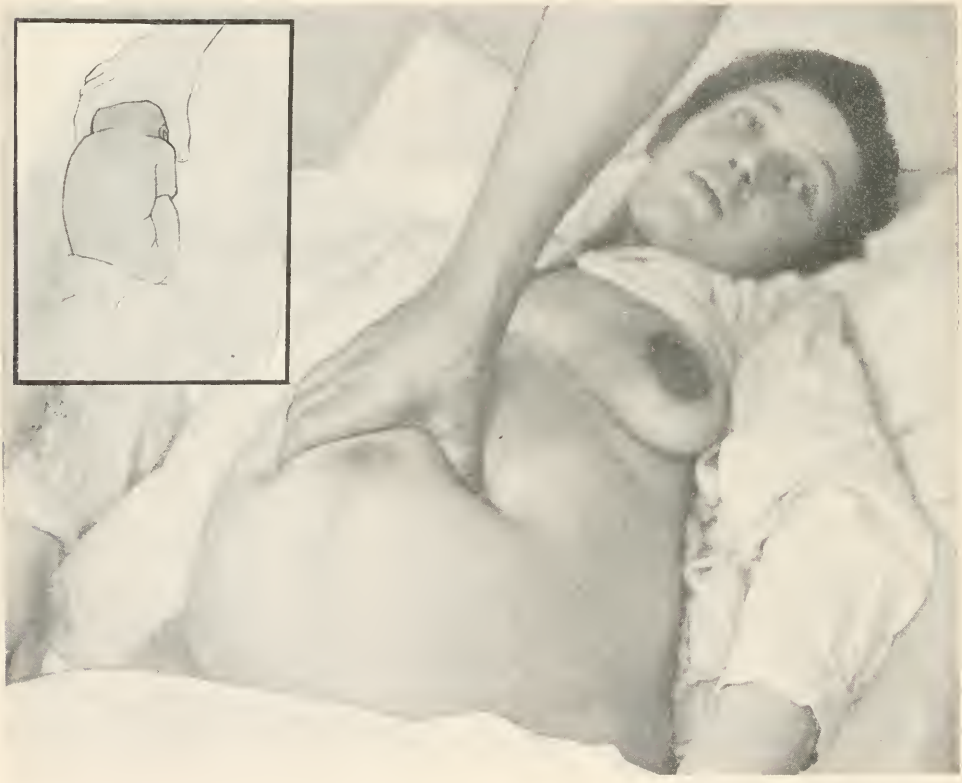

FIG. 200.—LOCATING THE CEPHALIC EXTREMITY OF THE FETUS IN BREECH PRESENTATION BY EXTERNAL PALPATION.—(*From a photograph taken at the Emergency Hospital.*)

the other hand the anterior shoulder can be recognized as a rounded prominence, which when on the left of the median line, indicates a left fetal position, and when on the right, a right fetal position. When the shoulder is less than two inches from the median line, the fetal position will be anterior; when more than two inches away, posterior (Fig. 199).

8. Palpation in Breech Presentation (Fig. 200).—The flexed band is pressed transversely across the maternal abdomen just at or above the umbilicus and the head grasped and palpated (Fig. 200). Or we can proceed as in palpation of the upper fetal pole (Fig. 196). The anterior shoulder (Fig. 199), the dorsal plane, and small parts (Fig. 195) are palpated practically as in head presentations.

9. Palpation in Shoulder Presentation (Fig. 201).—The same general principles apply here as in head and pelvic presentations.

10. Location of the Fetal Heart (Fig. 171).—This may be accomplished with the stethoscope, with the phonendoscope, or by the ear alone. The abdominal wall should be pressed against the uterine tumor, since sound is best transmitted through a homogeneous solid. This is best accomplished by pressing the fundus with one hand, and directing the uterus downward and forward (Fig. 171). It is advisable to direct this pressure in such a manner as to bring simultaneously the dorsal surface of the fetus as nearly as possible under the

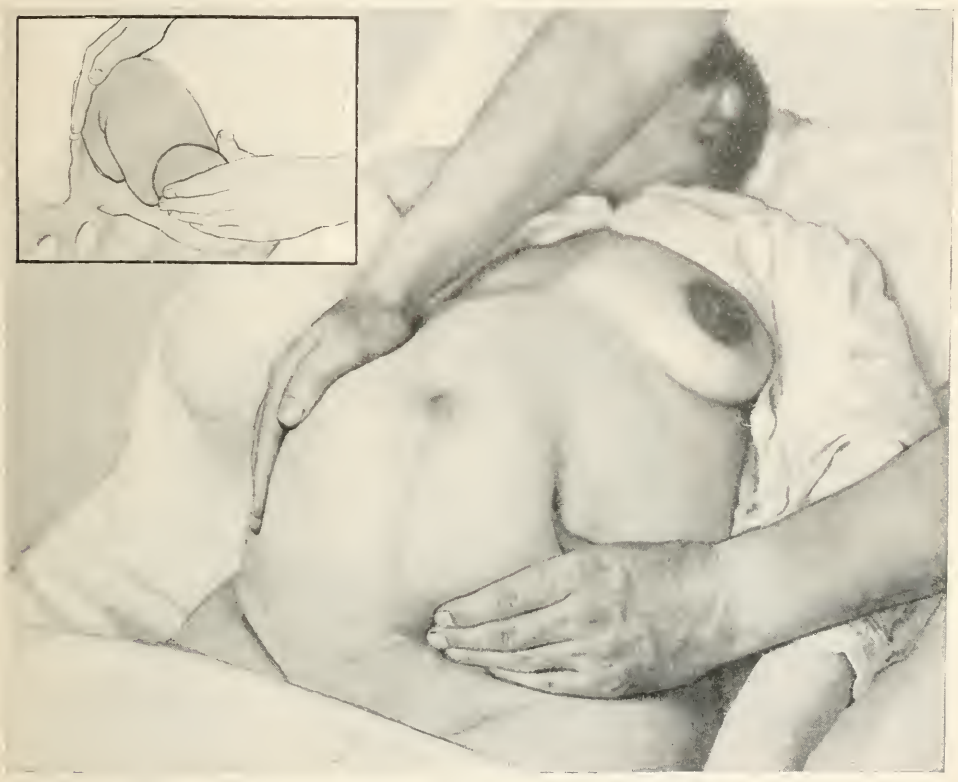

FIG. 201.—LOCATING THE CEPHALIC AND PODALIC EXTREMITIES OF THE FETUS IN SHOULDER PRESENTATION BY EXTERNAL PALPATION. The left hand grasps the head and the right the breech.—(*From a photograph taken at the Emergency Hospital.*)

stethoscope. The sounds resemble the ticking of a watch under a pillow, and vary from 130 to 140 per minute, being about twice as frequent as those of the healthy adult heart. Active movement on the part of the fetus increases the fetal heart-rate. If the organ is located on the left,—that is, if the point of greatest intensity of the heart sounds is on the left of the median line,—the presentation is left; if on the right, the presentation corresponds. If the heart is located above the umbilicus, the presentation is pelvic; if below, the head will present. Twins show naturally two hearts of different rates, and the sex can sometimes be guessed at by remembering that a persistent fetal heart rate under 120 indicates a boy; and over that, a girl. In certain dorso-posterior

positions, and in some cases of hydramnios, it is occasionally impossible to hear the fetal heart.

EXTERNAL PELVIMETRY.

In taking the external pelvic measurements the pelvimeter and tape-measure are necessary. Two very good instruments in common use are the pelvimeters of Baudelocque (Fig. 203) and of Schultze (Fig. 202). The former must be used with caution on account of the spring of the metallic arms. The modification of the Baudelocque pelvimeter, elliptical in shape, occasionally seen at the instrument-makers, has even greater spring than the original, and should be avoided if accurate results are desired. The Schultze pelvimeter is of a shape which gives great firmness, and is convenient to carry in the pocket or obstetric bag. In use the arms of the pelvimeter are separated, a rod being taken in each hand, with an index-finger on each knob. The knobs are then placed on the two selected points, fixed in position, the screw near the handle is tightened by an assistant, and the distance between the two points is read off on the scale attached to the instrument (Fig. 203). The patient should be dressed as for bed, and placed first in the dorsal position, upon the side of the bed or lounge. The physician standing at her right side, and holding an arm of the instrument with the thumb and fingers of each hand near the points, applies the latter to the outer edge of the anterior superior iliac spines, and notes the diameter thus gained (Fig. 203). He then pushes the points backward and forward along the outer edge of the iliac crest, and notes the greatest diameter which can in this way be obtained. The woman then turns on her side, or abdomen, and the points of the pelvimeter are placed on the posterior superior iliac spines, which are marked by well-defined dimples, and the distance between these is noted. The oblique diameter is obtained by placing one of the points upon the posterior superior iliac spine, and the other upon the anterior superior iliac spine of the opposite side. The external conjugate is obtained while the patient lies on her left side or stands in the erect position. One point is placed in the depression just below the spine of the last lumbar vertebra, while the other is placed upon the middle of the upper anterior border of the symphysis pubis. The distance between the femoral trochanters may be obtained by placing each point as nearly as possible upon the most projecting part of each greater trochanter. This last is an unimportant diameter. In external pelvimetry we rely upon the following twelve measurements; the first four of which are most commonly used: (1) Interspinous. (2) Intercristal. (3) Between the great trochanters. (4) The external conjugate, or Baudelocque's diameter. (5) Right oblique diameter. (6) Left oblique diameter. (7) Between the posterior superior iliac spines. (8) Between the tubera ischii. (9) Transverse diameter of outlet. (10) Antero-posterior diameter of outlet. (11) Length of the symphysis. (12) Circumference of the pelvis. (13) True conjugate measured externally.

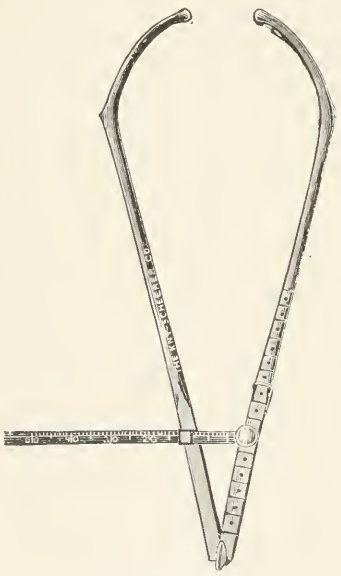

FIG. 202.—SCHULTZE'S PELVIMETER.

1. **Interspinous Diameter** (Fig. 203).—This is the widest distance between the anterior superior iliac spines, and is measured by placing the points of the pelvimeter upon the external surfaces of the spines, at the insertion of the sartorius muscles (Fig. 203). In normal pelves this measurement varies from 9½ to 10½ inches (24.1 to 26.7 cm.).

2. **Intercristal Diameter** (Figs. 203 and 204).—This is the widest interval

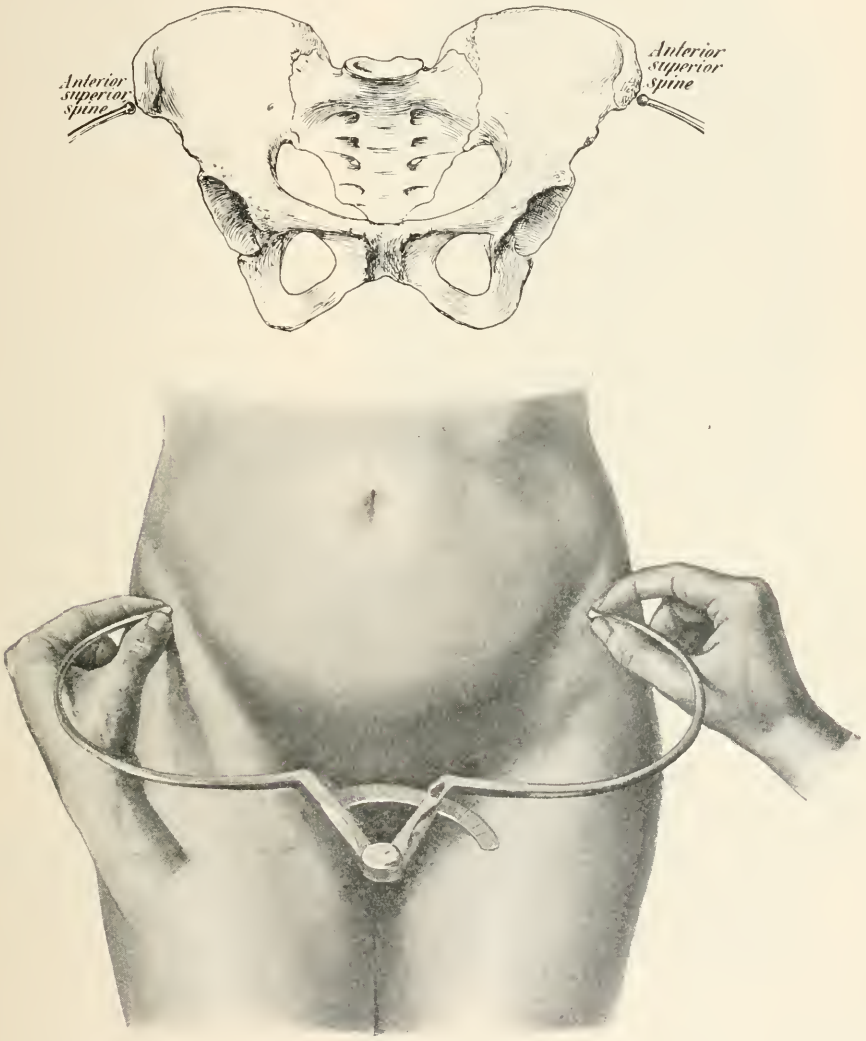

FIG. 203.—MEASURING THE INTERSPINAL DIAMETER WITH THE BAUDELOCQUE PELVIMETER.

between the iliac crests, and is measured between the most prominent portions (Fig. 204). In normal pelves this diameter varies from 10½ to 11½ inches (26.7 to 29.1 cm.).

3. **Between the Great Trochanters** (Fig. 209).—This diameter is the greatest distance between the external surfaces of the great trochanters of the femora. In normal conditions it measures 12.4 inches (31 cm.), but may even be 11½

inches (29.1 cm.), without indicating pelvic contraction. Because of variations in the size of the femoral head, this diameter is the most unreliable one of those here mentioned.

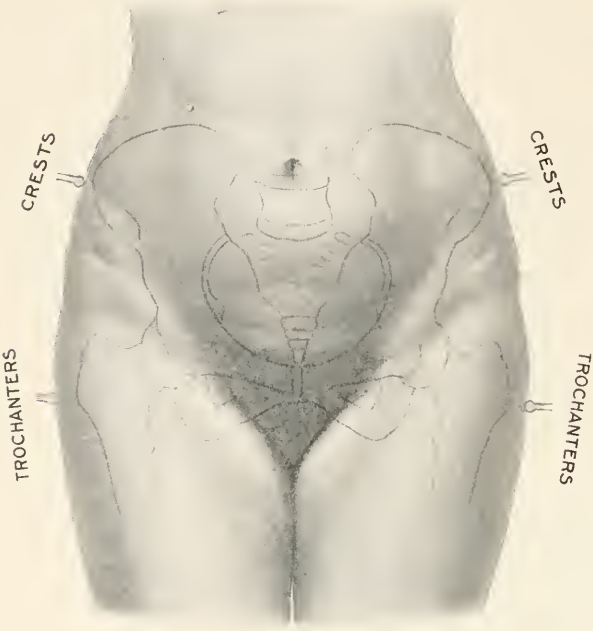

FIG. 204.—POSITION OF THE POINTS OF THE PELVIMETER FOR MEASURING THE INTERCRISTAL AND BITROCHANTERIC DIAMETERS OF THE PELVIS.

4. The External Conjugate; Baudelocque's Diameter (Figs. 206 and 207).—This is measured from the depression just below the spine of the last lumbar vertebra, which is about one inch above the posterior interspinous diameter, to the point on the skin of the mons veneris in front of the upper external edge of the symphysis pubis. In normal cases it measures 8 inches (20.3 cm.). As a clinical index of contracted pelvis this diameter is unreliable. According to Jewett, however, when the external conjugate is at or below 6 inches (15.2 cm.), or even below $6\frac{1}{4}$ inches (15.8 cm.), the pelvis is invariably contracted; between $6\frac{1}{2}$ inches (15.8 cm.) and 8 inches (20.3 cm.) the amount of contraction is very uncertain, and must be settled by internal measurements; at or above 8 inches (20.3 cm.) the pelvis is almost sure to have ample room. A certain relationship is said to exist between the lengths of the external and internal conjugates; such marked variations, however, occur between the two that the external can never be relied upon as an exact clinical index of the internal. Litzmann measured the external conjugate during life, and the internal or true conjugate post mortem in 30 cases, and found that there was an average difference between the two of $3\frac{3}{4}$ inches (9.5 cm.). In the entire 30 cases, there were variations from $2\frac{3}{4}$ inches (7 cm.) to $4\frac{15}{16}$ inches (12.5 cm.).

FIG. 205.—POSITION OF THE POINTS OF THE PELVIMETER FOR MEASURING THE RIGHT EXTERNAL OBLIQUE DIAMETER OF THE PELVIS.

5 and **6. Right and Left External Obliques** (Fig. 205).—The right external

oblique is measured from the right posterior superior spine of the ilium to the left anterior superior spine, and measures $8\frac{3}{4}$ inches (22 cm.). The left external oblique is the distance from the left posterior superior spine of the ilium to the right anterior superior spine, and measures also $8\frac{3}{4}$ inches (22 cm.). These right and left oblique diameters should be equal or nearly so. In obliquely contracted pelves, as the single oblique pelvis of Naegele, a considerable difference may be present. In such pelves several other oblique measurements are of value, in order to determine differences between the two lateral halves of the pelvis, although in these cases, more than in any other, an external examination is necessary to detect the exact degree of deformity. Three additional measurements are: (1) From the posterior superior spine of one side to the tuber ischii of the other. (2) From the spine of the last lumbar vertebra to the anterior superior iliac spines of both sides. (3) From the posterior superior spine of one side to the great trochanter of the opposite side. (4) From the lower margin of the symphysis to the posterior superior iliac spines. (5) From the middle line of the back to both posterior superior iliac spines.

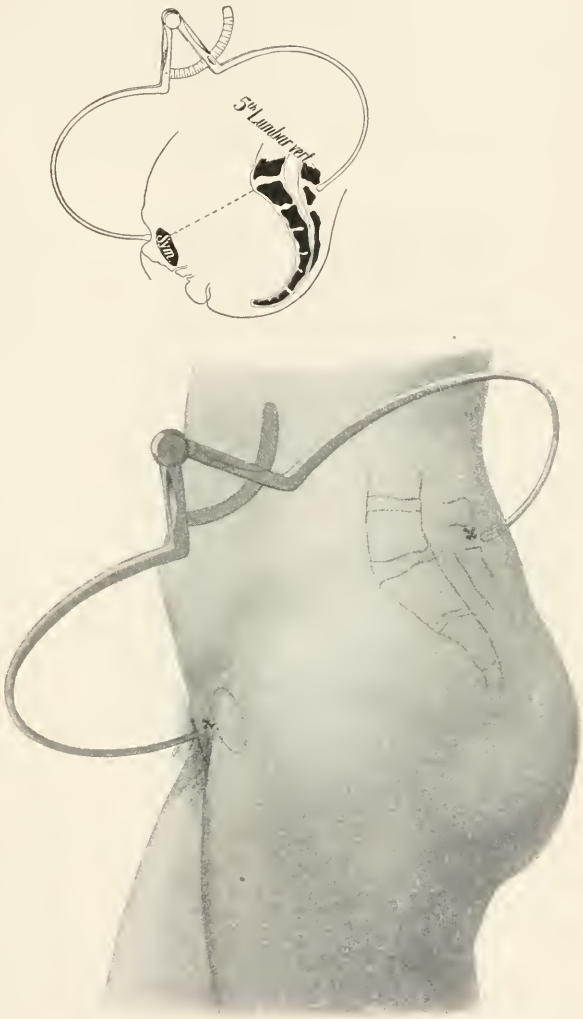

FIG. 206.—MEASURING THE EXTERNAL CONJUGATE DIAMETER OF THE PELVIC INLET. DIAMETER OF BAUDELOCQUE. BAUDELOCQUE PELVIMETER.

7. Between the Posterior Superior Iliac Spines.—This is measured from the outer surfaces of these spines, and equals normally $3\frac{7}{8}$ inches (9.8 cm.).

9. Transverse Diameter of the Outlet (Fig. 209).—This diameter is rarely referred to, and less often taken, but it is of great value in showing contraction at the pelvic outlet in kyphotic and funnel-shaped pelves. With the patient in the lithotomy position, the palmar surfaces of the index-fingers are pressed firmly against the inner borders of the tuber ischii, and an assistant then measures the diameter with the points of the pelvimeter placed on the index-fingers, close to the ischial bones (Fig. 209).

Normally this diameter is $4\frac{1}{4}$ inches (11 cm.). The transverse diameter of the outlet may be measured with equal facility by determining the distance between the ischial tuberosities. The site of the latter is located by the points at which a horizontal line touching the anterior margin of the anus comes in contact with the folds of the thigh. The knobs of the pelvimeter are applied at these points, the shanks of the instrument having previously been overlapped, and pressed firmly against the subjacent bones. The measurement thus obtained is normally $4\frac{1}{2}$ inches (11.43 cm.). There should be allowed for the soft parts about $\frac{1}{4}$ inch (0.635 cm.), varying with the thickness of the nates. The true transverse diameter of the outlet is therefore $4\frac{1}{4}$ inches (11 cm.).

10. Antero-posterior Diameter of the Outlet.—The woman is placed on her side and the examiner introduces his index-finger into the vagina, with the thumb over the region of the coccyx. By moving the latter bone back and forth, the location of the sacro-coccygeal joint is determined, and a pencil mark is made upon the superjacent skin. One button of the pelvimeter is applied over this mark, while the other rests within the vulva, and upon the lower border of the symphysis. The straight or antero-posterior diameter of the outlet is thus determined, and is normally 5 inches (12.5 cm.). About $\frac{1}{3}$ inch (1.5 cm.) must be subtracted from the thickness of the coccyx and soft parts to obtain the actual or net measurement. The preceding method is known as Breisky's, and is endorsed by Skutsch. This diameter can usually more readily be measured directly with the fingers internally (Fig. 208).

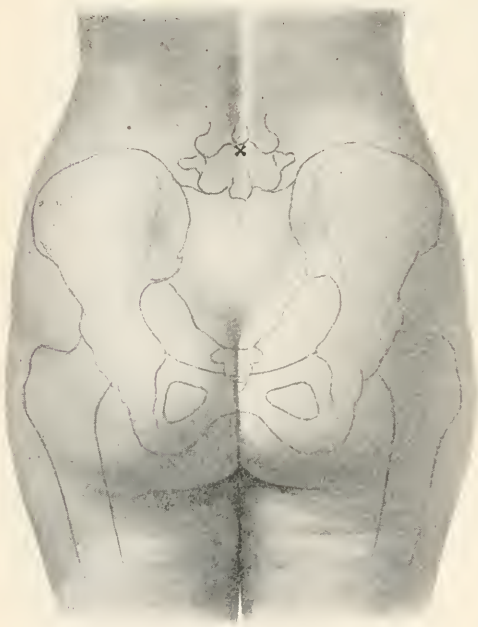

FIG. 207.—POINT (X) BELOW THE SPINE OF THE LAST LUMBAR VERTEBRA USED TO INDICATE THE POSTERIOR EXTREMITY OF THE EXTERNAL CONJUGATE OF THE PELVIC INLET.

11. Length of the Symphysis (Fig. 213).—This is important in determining the depth of the true pelvis, and in assisting in the estimation of the true from the diagonal conjugate. It is measured with a pelvimeter by pressing one point closely down upon the center of the upper border of the symphysis, and the other point against the center of the subpubic ligament. It can also be estimated with the fingers (Fig. 213).

12. External Circumference of the Pelvis.—This is measured with the tape-measure over the middle of the symphysis, just below the iliac crests, and across the middle of the sacrum, and is usually about $35\frac{1}{2}$ inches (88.75 cm.).

13. The True Conjugate Measured Externally.—In thin, non-pregnant women, and in the early months of gestation, the true conjugate may occasionally be estimated directly from without, by placing the palmar surface of the hand upon the hypogastrium, and pressing backward until the tips of the fingers reach the promontory. The hand is then marked over the pubes with a finger-nail

of the disengaged hand, and after allowing for the thickness of the abdominal walls and pubes, the estimate is made. The method is of little practical value. A graduated rod with a blunt surface for pressing against the sacral promontory may be substituted for the hand.

These external measurements are not trustworthy, since errors of as much as two inches may occur. They rather point out the general shape of the pelvis and not the exact pelvic capacity. Baudelocque's conclusion that the external conjugate minus from $2\frac{3}{4}$ to 5 inches (7 to 12.5 cm.) equals the internal true conjugate is now known to be untrustworthy. Of the above the diameters of the most practical importance are the (1) interspinal, (2) intercristal, (3) external conjugate, (4) transverse of outlet, and (5) antero-posterior of outlet. A marked diminution in the interspinal and the intercristal diameters leads to the suspicion of a transversely contracted pelvis. If the intercristal diameter is no greater than the interspinal, or if it is less, the pelvis is probably rachitic. A difference in the lateral halves of the pelvis is shown by a difference in the oblique diameters; while a notable diminution in the external conjugate shows that we have to deal with a flattened pelvis. Unlike the case of the true conjugate, it is not safe to make inferences as to the length of the internal transverse diameter of the lesser pelvis, from these external measurements, because there are too many opportunities for disparities in the shape and size of the ilia. The nearest approximation to a rule, which, however, holds good in not more than fifty per cent. of cases, is that the interspinous line is twice as long as the transverse diameter of the lesser pelvis. These external measurements, however, have some value in other directions. Thus, if the spine and crest measurements exhibit little or no difference, the pelvis in question is probably rachitic. The external measurements should always be compared, for if each has the normal length, the lesser pelvis should be regarded as normal. But if the interspinous line is as long as the intercristal, or longer, the external conjugate is unnaturally short, and these disparities indicate the existence of a flat, rachitic pelvis. Again, if the three external measurements are in the normal proportion to one another, but are all unnaturally short, they indicate the existence of a generally contracted pelvis, the most common variety in the United States.

INTERNAL OR VAGINAL EXAMINATION. INTERNAL PELVIMETRY.

An internal pelvic examination is imperative in all primigravidæ, and in others upon whom the least suspicion of pelvic deformity rests. The same care in the preparation of the patient and of the physician's hands should be taken at this time as in internal examinations during labor.

Objects of the Examination.—In the internal or vaginal examinations we strive (1) to confirm the findings of the external examination in regard to (*a*) the actual existence of pregnancy; (*b*) the period of gestation; (*c*) the probable date of labor; (*d*) the viability of the fetus; (*e*) the presentation, position, and engagement of the head. (2) In addition, we seek information as to the conditions of the soft parts, as to congenital defects, pathological growths which may obstruct or complicate labor, or injuries resulting from previous deliveries. (3) The possibility of a placenta prævia should always be kept in mind. (4) The size of the pelvis should be estimated, and (5) the obstetric diagnosis confirmed and completed.

INTERNAL PELVIMETRY.

For internal pelvimetry many instruments have been devised, but the best of all is the educated hand. We have, therefore, manual and instrumental pelvimetry. After the usual disinfection of the vulva, and of the hands and arms of the physician, the patient is placed in the lithotomy position, with the hips projecting well over the edge of the bed or table. The first and second fingers are then introduced into the vagina and passed well upward toward the promontory of the sacrum. With these two fingers the general conformation and capacity of the pelvis, the pelvic inclination, the depth, inclination, and thickness of the symphysis pubis, the shape and curve of the sacrum, the flexibility of the coccyx, and, with the assistance of the external pressure upon the fundus, any marked disproportion between the fetal head and pelvis, can be determined (Fig. 226). Several internal pelvic diameters will demand measurement in cases of suspected deformity, although usually the diagonal and true conjugates are a sufficient clinical index of the pelvic capacity. These diameters are: (1) the sacro-pubic; (2) the pubo-coccygeal; (3) the transverse diameter of the outlet; (4) the diagonal conjugate; (5) the true conjugate; (6) the transverse diameter of the inlet.

1. **The Sacro-pubic Diameter** (Fig. 208).—With two fingers in the vagina, the tip of the second finger seeks and presses firmly against the sacro-coccygeal joint, and the radial edge of the hand is brought up firmly against the subpubic ligament. A finger-nail of the other hand then marks the point of junction at the apex of the pubic arch (Fig. 208). The vaginal fingers are now withdrawn, and the distance between the two points of contact is measured with a pelvimeter or tape-measure. Normally this diameter measures $4\frac{1}{2}$ inches (11.5 cm.).

2. **The Pubo-coccygeal Diameter.**—This is measured in the same manner as the above, but from the subpubic ligament to the tip of the coccyx. In anterior positions of the coccyx this diameter is about $4\frac{1}{2}$ inches (11.5 cm.), but recession during expulsion of the head may readily increase the diameter to $5\frac{1}{2}$ inches (14 cm.).

3. **Transverse Diameter of the Outlet.**—This has been described under external pelvimetry (page 162, Fig. 210). During labor, or under partial anesthesia, this diameter can be estimated by pushing the half-fist between the ischial tuberosities and partly into the vaginal orifice. The width of the four fingers or knuckles is then compared with the bisischial space. (Compare Manual Pelvimetry.)

4. **The Diagonal Conjugate** (Fig. 209).—This is the distance from the center of the sacral promontory to the subpubic ligament. To measure it manually, the first and second fingers of either hand are introduced into the vagina, and the sacral promontory is sought for. Some experience is necessary to be able to recognize the promontory, and care should be taken not to mistake a "false promontory" for the true one. Unless the deformity is extreme it will be the second finger which touches the promontory. Keeping the finger in contact with the latter, the radial side of the first finger or hand is held firmly against the subpubic ligament, while the exact point of contact is marked by the finger-nail of the first finger of the other hand (Fig. 209). The fingers are then withdrawn, and the distance is measured with the pelvimeter (Fig. 211) or tape, the examining hand being held in the same relative position. This diameter in normal pelves measures $5\frac{1}{4}$ inches (13.5 cm.).

5. **The True Conjugate.**—The true conjugate can be estimated from the

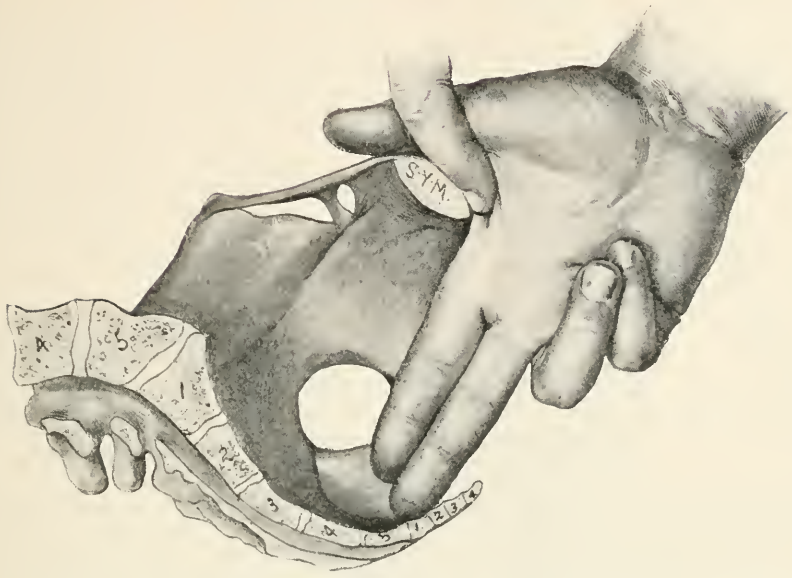

FIG. 208.—DIGITAL METHOD OF MEASURING THE ANTERO-POSTERIOR DIAMETER OF THE PELVIC OUTLET.—(*From a photograph.*)

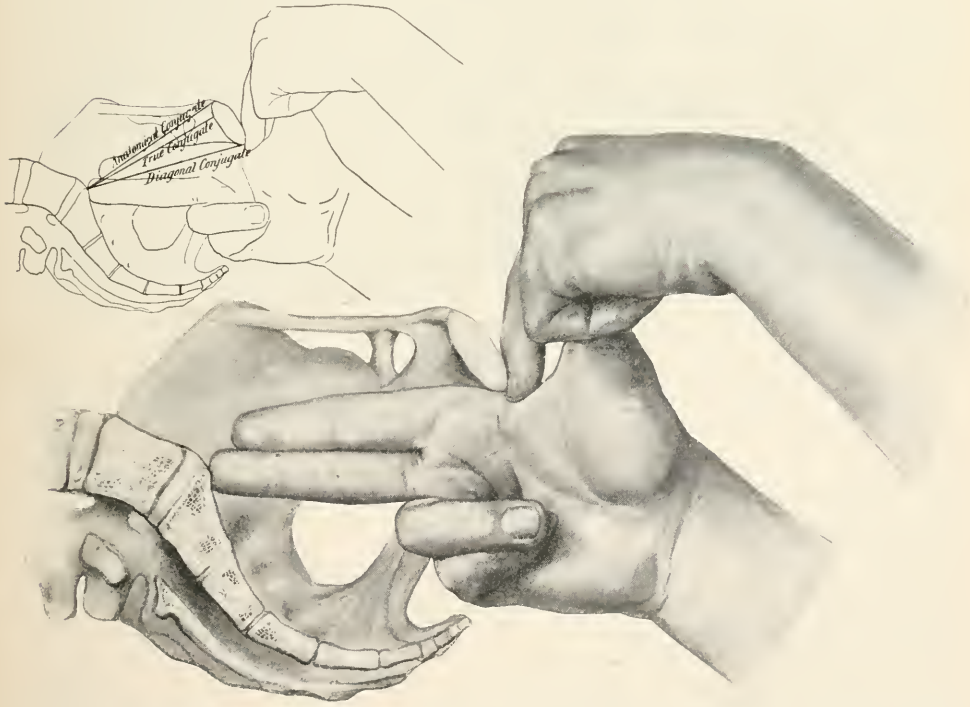

FIG. 209.—DIGITAL METHOD OF MEASURING THE DIAGONAL CONJUGATE OF THE PELVIC INLET.—(*From a photograph.*)

diagonal conjugate, by constructing a triangle formed by the two conjugates and the symphysis pubis, of which the diagonal conjugate corresponds nearly to the hypothenuse, and the true conjugate to the base. The diagonal conjugate, the known quantity, is the longest of the three sides, and the true conjugate, the unknown quantity, can be obtained from it by subtracting on an average 1 inch (2.5 cm.). The amount to be deducted, however, will vary with the height, thickness, and inclination of the symphysis and the height of the sacral promontory. When the symphysis is $1\frac{1}{2}$ inches (3.75 cm.) or over, $\frac{3}{4}$ inch (1.905 cm.) should be subtracted from the diagonal conjugate; and when it is less than $1\frac{1}{2}$ inches (3.75 cm.), a little less is to be subtracted. The esti-

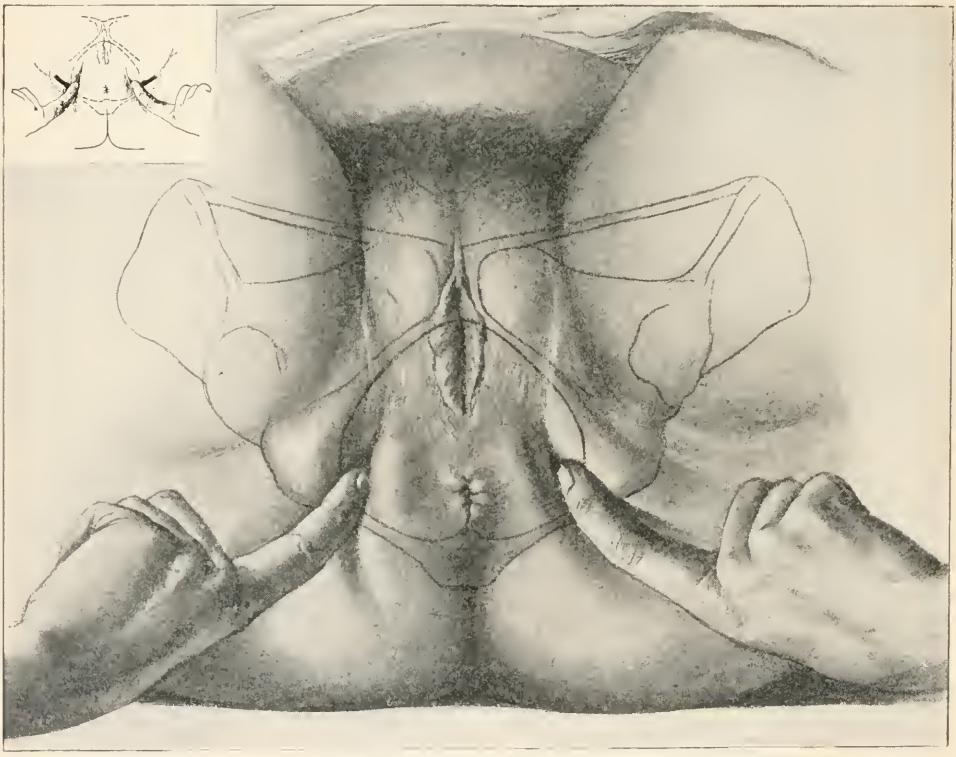

FIG. 210.—METHOD OF MEASURING THE TRANSVERSE DIAMETER OF THE PELVIC OUTLET. The points of the pelvimeter are placed on the palmar surfaces of the tips of the index-fingers. See diagram, upper left of illustration.—(*From a photograph.*)

mation of the true conjugate by this plan can only be approximated, since it depends upon so many variable quantities. The method of taking the height of the symphysis is described on page 166. For determining the thickness of the symphysis the pelvimeter of Skutsch, or one of its modifications, may be used (Fig. 215). It can be roughly estimated, of course, by the thumb and finger of the accoucheur (Fig. 213). The normal angle between the true conjugate and the symphysis has been estimated at 105 degrees. After the physician has made it a rule to combine internal pelvimetry with vaginal examination, he will soon learn to recognize and appreciate departures from the normal type. An important point, commonly misunderstood, is that the obstetric con-

jugate is the smallest amount of available intrapelvic space in the antero-posterior diameter, whether measured from the true promontory or some other point, as a false promontory or displaced lumbar vertebra.

True Conjugate with Pelvimeters (Skutsch).—Many pelvimeters have been devised for measuring the true conjugate. These instruments, as a rule, do not take cognizance of other internal diameters. Two instrumental methods for measuring the true conjugate give practical results: viz., those of Skutsch and Farabeuf respectively. The measurement which the former gives is known as the interno-external, and is not so accurate as that obtained by the direct method with the latter or Farabeuf's instrument. (See page 172 and Fig. 214.) Eight years' experience with this instrument has satisfied the author that it is the most accurate instrument for the purpose at present in existence.

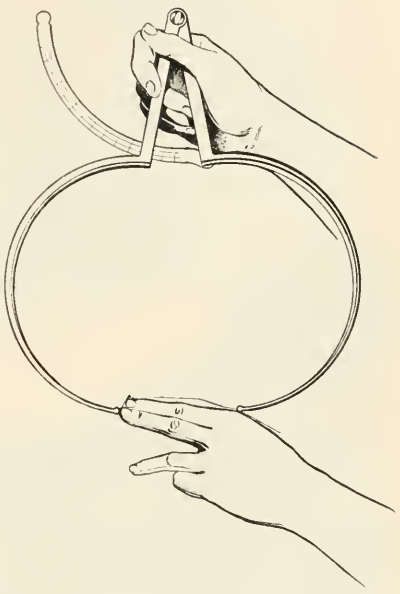

FIG. 211.—MEASURING THE DISTANCE FROM THE END OF THE SECOND FINGER TO THE MARK MADE UPON THE RADIAL BORDER OF THE HAND.

The Skutsch pelvimeter is about the shape of a pair of calipers (Fig. 215). Its internal arm is of steel, with a spatula-like tip, while its fellow is of pure lead covered with india-rubber tubing. To determine the true conjugate, the woman is placed in the dorsal position, with knees elevated and thighs separated. The sacral promontory is first located, and then the projecting point on the internal aspect of the symphysis. A point is then selected upon the mons veneris corresponding to an imaginary continuation of the true conjugate, and indicated by a crayon mark. The internal or steel arm is then introduced into the vagina, with the finger as a guide, and its spatula-like tip applied firmly to the promontory and there maintained, while with the other hand the lead arm is given such a contour that its terminal knob is placed near the marked spot upon the mons. The external hand then gives the pelvimeter a slight twist upon its axis, after which the knob of the external arm may be pressed accurately upon the marked spot. The pelvimeter is then locked and withdrawn. The distance is measured by the scale accompanying the instrument. The internal arm of the pelvimeter is then applied to the internal aspect of the symphysis, and its distance from the marked point upon the mons veneris is determined, in the same manner as was the first measurement. Subtraction of the small from the large measurement gives the length

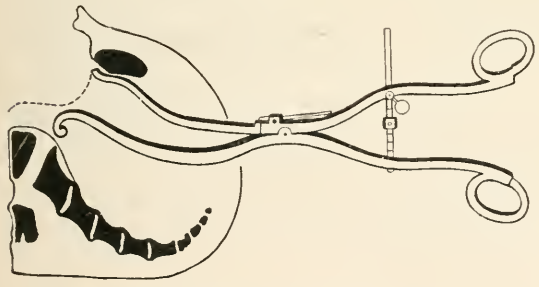

FIG. 212.—STEIN'S PELVIMETER FOR MEASURING DIRECTLY THE TRUE CONJUGATE.

of the true conjugate. The Skutsch pelvimeter is in like manner used to measure the transverse diameter of the pelvic inlet. (See Fig. 216.)

True Conjugate with the Farabeuf Pelvimeter.—This resource was introduced into pelvimetry by Farabeuf * for the purpose of lengthening the index-finger, in case the accoucheur should be unable to reach the promontory, either by reason of the shortness of his finger, or because of unusual dimensions of the pelvis. While fingers of average length are sufficient for pelvimetry in contracted pelves, this is by no means necessarily the case in general pelvimetry, and therefore the device of Farabeuf is excellent in routine obstetrical practice. The custom of reinforcing the finger with a vesical sound is open to criticism, from the fact that it may be given a wrong direction; and a further disadvantage is the absence of a device to indicate the exact position of the symphysis. The thimble-like pelvimeter consists of two delicate steel arms, which are parallel for a short distance, but which then diverge, and afterward roughly assume the contour of a tapering forefinger. This frame is provided, on its inferior surface, with two incomplete rings, designed to fit the first and second phalanges of the exploring finger. The elasticity of the steel arms permits the rings to slip over a finger of any normal dimensions. Attached near the extremity of this steel frame is a delicate horse-shoe-shaped piece of steel, which turns in either direction, up or down, and which constitutes the extension to the exploring finger (Fig. 214). The parallel portion of the steel arms also constitutes a groove, along which slides the measuring rod, which is bent at its terminal end into a right angle. This bent portion is intended to enter the urethra in order to touch the internal aspect of the symphysis. The proximal end is provided with a ring, while the upper surface of the rod has a graduated index (Fig. 214). With this pelvimeter the obstetrical conjugate can be measured directly. The steel arms are introduced against the promontory, followed by the passing of the measuring rod into the bladder (Fig. 214).

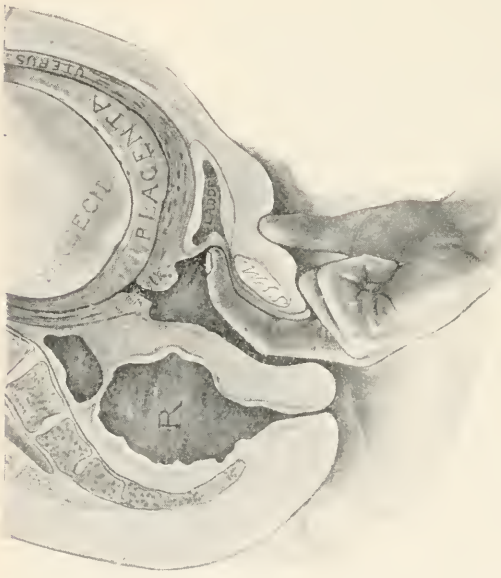

FIG. 213.—MEASURING THE HEIGHT AND THICKNESS OF THE SYMPHYSIS WITH THE FINGERS. This procedure is also useful to determine the amount of engagement of the presenting part or the effect of the uterine contractions in causing descent of the head or breech.

6. Transverse Diameter of the Inlet (Fig. 216).—Exact measurements of the transverse diameter of the brim are as yet hardly practicable. The pelvimeter of Skutsch is an example of what has been done in this direction (Fig. 216). To obtain the transverse diameter at the pelvic inlet with this instrument, the woman is placed in the dorsal position with her extremities in leg-holders. The fingers of the left hand are introduced within the vagina and along the

* "Gaz. Hebdom. de Méd. et Chir.," June, 1889.

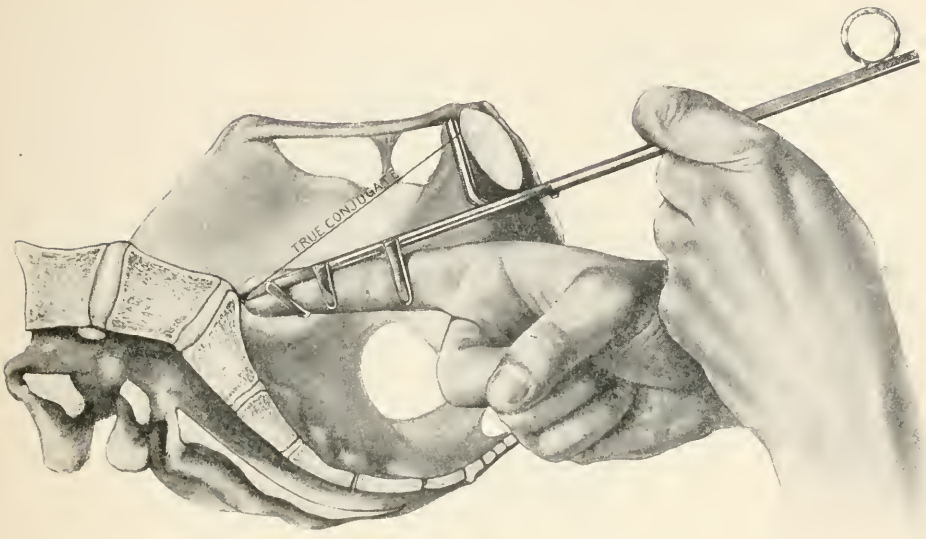

FIG. 214.—DIRECT INSTRUMENTAL METHOD OF MEASURING THE TRUE CONJUGATE OF THE PELVIC INLET WITH THE FARABEUF PELVIMETER.—(*From a photograph.*)

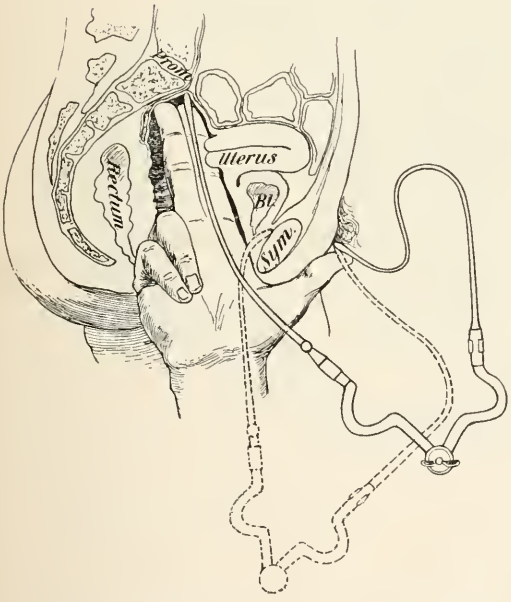

FIG. 215.—MEASURING THE TRUE CONJUGATE OF THE PELVIC INLET WITH THE SKUTSCH PELVIMETER.

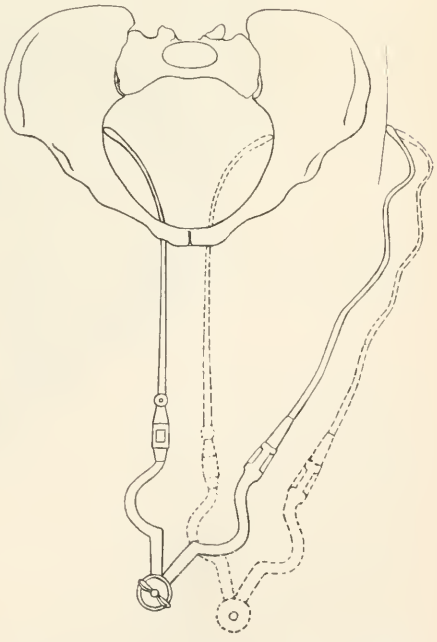

FIG. 216.—MEASURING THE TRANSVERSE DIAMETER OF THE PELVIC INLET WITH THE SKUTSCH PELVIMETER.

FIG. 217.—DIRECT INTERNAL MANUAL PELVIMETRY IN A NORMAL PELVIS. The width of the hand is 3½ inches (9 cm.). Note the free space between the promontory and small finger.—(*From a photograph.*)

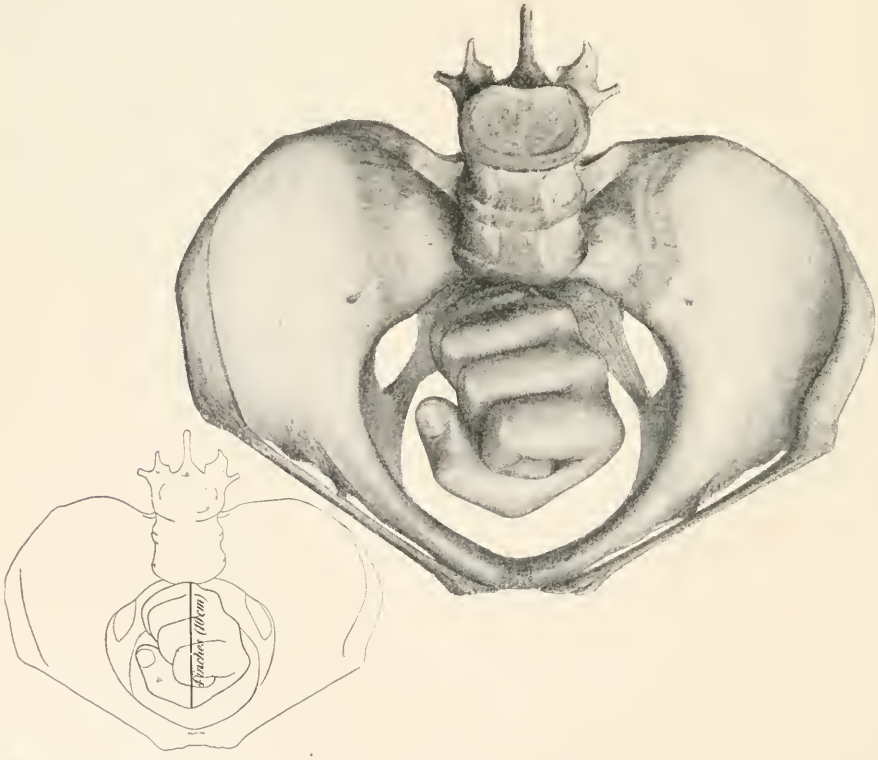

FIG. 218.—DIRECT INTERNAL MANUAL PELVIMETRY IN A NORMAL PELVIS. The long diameter of the closed fist is 4 inches (10 cm.). Note the unoccupied room to the front and sides of the fist.—(*From a photograph.*)

linea arcuata, while the right hand locates the point at which an imaginary continuation of the transverse diameter would transfix the skin in the region of the hip. This point is indicated by a crayon mark. The error in the determination of this point is said to be very slight. The internal arm of the pelvimeter is now introduced within the vagina, and its tip is applied to the left extremity of the transverse diameter, while the knob of the lead arm is similarly applied over the hip and the short measurement taken. The steel arm within the vagina is now reversed, so that its convexity faces about; the opposite extremity of the transverse diameter is then located, and the long measurement made. The difference between the two gives the diameter sought. An internal measurement sometimes taken in order to estimate the transverse

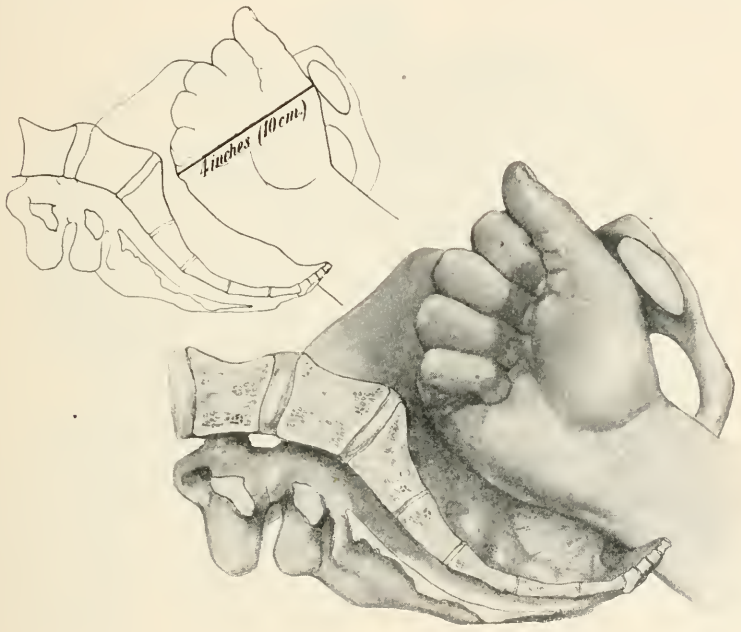

FIG. 219.—DIRECT INTERNAL MANUAL PELVIMETRY IN A NORMAL PELVIS. The long diameter of the fist as thus placed in the pelvis measures 4 inches (10 cm.). Note the space between the promontory and the knuckle of the small finger.—(*From a photograph.*)

diameter of the pelvic brim is that of Löhlein. With two fingers in the vagina, the distance from the center of the ligamentum arcuatum to the upper anterior angle of the great sacro-sciatic notch is taken. According to Löhlein, this is ¾ inch (2 cm.) less than the transverse diameter of the inlet. The practised hand will soon learn to appreciate any notable transverse contraction in palpating the lateral pelvic walls.

Internal Manual Pelvimetry.—Internal manual pelvimetry comprises palpation of the pelvic canal by the fingers introduced within the vagina, and measurement of the pelvic diameters by the aid of the entire hand. Palpation of the pelvic canal serves to detect the presence of objects which obstruct the lumen of the pelvic canal, such as abnormally long bony prominences. But unless favored by circumstances which render possible the introduction of the

entire hand into the vagina, such as large size and great distensibility of the latter, the value of mere palpation of the pelvic canal is not great.

For a number of years the author has practised a variety of manual pelvimetry shown in figures 217 to 221. The originator of this method was Dr. Robert Wallace Johnson, of England. It necessitates the introduction of the whole hand into the pelvis, a distensible vagina, and narcosis of the patient. It is inapplicable in nulliparous patients, and in many primigravidæ before labor sets in, but can be used to advantage in most multigravidæ, and in all parturients. In all primiparæ and many multiparæ considerable care and time must be used in the dilatation of the vagina, so as to avoid rupture of that organ or of varicose veins so often present. Troublesome venous hemor-

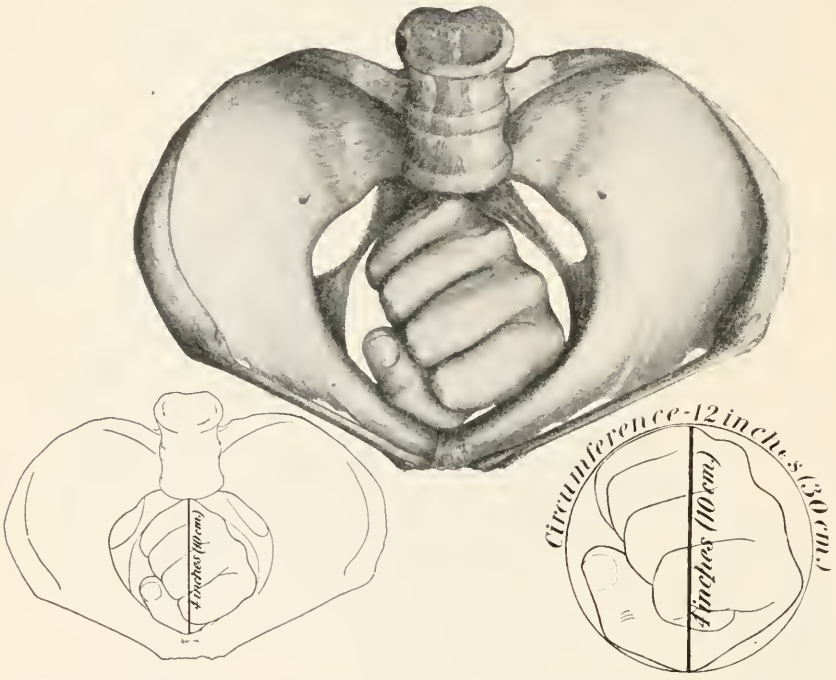

Fig. 220.—Direct Internal Manual Pelvimetry in a Generally Contracted Pelvis. Note that the long diameter of the fist reaches from promontory to symphysis. Also that the circumference of the fist almost blocks the pelvic inlet.—(*From a photograph.*)

rhage from the latter source once occurred in my practice from a too rapid dilatation. As the illustrations indicate, the measurements of the pelvic inlet are compared with the known circumference and diameters of the tightly closed fist. When applicable, the method is the most positive and satisfactory of the internal means for determining the available space at the inlet.

It should not be forgotten that pelvic contraction is usually relative, not absolute, and that the size of the fetal head is just as important as the size of the pelvis. The size and compressibility of the head, and whether it can be made to enter the pelvic brim, are factors that should never be neglected. (See Cephalometry.) Finally, the importance in doubtful cases of a thorough examination under full anesthesia, and by an experienced accoucheur, cannot be overestimated. It is hardly necessary to point out all the refinements of

diagnosis in the various forms of pelvic deformity. The educated hand will recognize the difference in the respective lateral pelvic walls, which accompanies the obliquely contracted pelvis (Naegele); the converging walls and approximated ischial tuberosities, which characterize the funnel-shaped pelvis (Roberts); the presence of bony tumors, etc. The student who has mastered the principles of pelvimetry, and the descriptive classification of pelvic deformity, will not need exact instruction for every possible case.

RÖNTGEN PELVIMETRY.

The *x*-rays are able to detect anomalies of the bony pelvis, including narrowing of the inlet. We therefore possess a new resource in pelvimetry. According to Bouchacourt, the rays give us three species of information: (1) As to

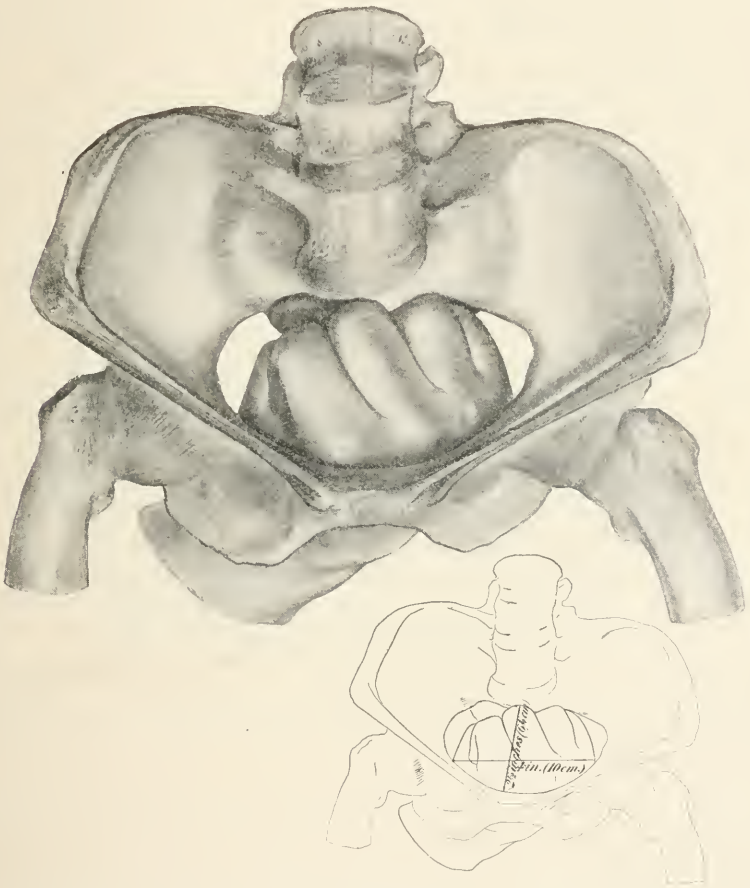

FIG. 221.—INTERNAL DIRECT MANUAL PELVIMETRY IN A FLATTENED AND GENERALLY CONTRACTED PELVIS. Note that the fist almost fills the pelvic inlet.—(*From a photograph.*)

the presence or absence of deformity in general. (2) As to whether the deformity is symmetrical or asymmetrical. (3) As to the nature of the deformity.* To practise Röntgen pelvimetry, the woman is placed upon the plate in a some-

* "L'Obstétrique," 1900, V, pp. 20–34.

what reclining position, the tube being above and in front of her; or she may lie in the lithotomy position, with the plate under the ischial tuberosities, if possible at a right angle with the pelvic axis, the tube being above the woman in a line with the said axis. Freund speaks of a third position—namely, the Trendelenburg—as specially adapted for pelvic photography. Finally, if a picture of the rear of the pelvis is desirable, the patient must lie prone with the plate beneath and the tube above her.' Williams * gives a method of his own devising, for measuring the transverse diameter of the pelvis at the inlet.

PELVIGRAPHY.

Attempts have been made to depict the entire pelvic cavity during life by some method of graphic representation. As far as I know, but two such methods have ever been proposed; these are skiagraphy of the pelvis, and the geometrical method of Neumann and Ehrenfest, assistants of Professor Schauta (Vienna). Skiagraphy of the pelvis is described under the sections on Röntgen Pelvimetry (page 177) and Röntgen Cephalometry (page 184).

The geometrical method consists in taking a series of measurements of certain pelvic diameters, and plotting the size and outline of various pelvic planes. The two transverse diameters and the sagittal plane are sufficient to give a complete notion as to the individuality of the pelvis. The authors just mentioned employ for this purpose an instrument termed by them a pelvigraph. The principle involved in the construction and application of the pelvigraph is that of the parallel rulers, one number representing a palpator for the localization of points within the pelvis, while the other is provided with a water-level and a dial index. There are several palpating arms, the peripheral portions of which are bent in various curves or angles, to reach different parts of the pelvis; but the proximal portion and the terminal button are always in the same axis. The various measurements, angles, etc., are plotted upon drawing-paper as soon as they are determined, and in this manner the entire sagittal plane is reproduced on paper. The transverse diameters should then be measured. This method may be found fully described and illustrated in the "Monatsschrift für Geburtshülfe und Gynäkologie," 1900.

Fabre's Method.—In 1900, Fabre, of Lyons, described before the International Medical Congress at Paris a method devised by him for measuring the superior strait, which he termed metric radiography. Exact mensuration with radiography is of course impossible, as the image varies with the distance between the ampulla and the various positions of the pelvis. But it is possible to measure the dimensions approximately by the method about to be described. Four rulers of metal, each provided with a certain number of saw-like teeth, form a square about the pelvis. The posterior ruler is opposite the posterior superior ischial spines, the anterior lies horizontally in front of the upper portion of the pubis, etc. A skiagram is then made, and the shadows of the teeth, which should be exactly opposite to one another, may be joined by straight lines, dividing the area of the pelvic shadow into minute squares, whereby the dimensions desired may be measured approximately.

CLISEOMETRY.

Cliseometry is the art of measuring the size of the angle of inclination of the planes of the pelvic inlet and outlet. For many years obstetricians have sought a practical and trustworthy method for determining these angles. Some authorities

* "The Röntgen Rays in Medicine and Surgery," 1901, p. 378.

have seen in cliseometry a valuable prospective resource in the differential diagnosis of pelvic deformities, while others believe that the subject of forceps-traction should benefit most from increased study of the inclination. Cliseometers have been devised by Naegele, Ritgen, Prochownik, and others, but no one apparatus has ever attained any considerable degree of recognition. Sources of error, cumbrousness, and general impracticability have thus far attended all attempts to systematize and popularize cliseometry. Neumann and Ehrenfest * have introduced a device for measuring the pelvic inclination, which they term a cliseometer (Fig. 222). It consists of a rigid curve (A), which carries at one end a hollow cylinder rod (B), so disposed that it lies directly in the axis of the free extremity of the curve, which is armed with a knob (C); the hollow cylinder contains a solid

FIG. 222.—METHOD OF MEASURING THE DEGREE OF PELVIC INCLINATION. CLISEOMETRY. (Instrument of Neumann and Ehrenfest.)

rod (D), which slides up and down, and is armed with a second knob (F). The two knobs are naturally in the same axis. The upper extremity of the moving rod contains a disc (G), which rotates in the direction of the length of the rod. The periphery of the disc is divided into degrees. Above and below are zero marks, and the numbering is so arranged that there are four quadrants of 90 degrees each. The disc is also provided with a water-level and an index. When the cliseometer is so placed that the axis in which the knobs lie is horizontal, the index points to 0. If the knobs are applied to the points used in measuring the external conjugate with a pelvimeter, and the disc is then rotated until the water-level is horizontal, the zero points are also horizontal. The angle

* "Monatsschrift f. Geburts. und Gynäkol.," 1900, vol. XI.

made by the cylindrical rod and knobs with the horizontal plane, or diameters between the zero marks, represents the inclination of the plane of the inlet.*

CEPHALOMETRY.

Various procedures have been devised for the determination of the diameters of the fetal skull, especially the biparietal and the bitemporal. Attempts have been made to measure the skull directly—that is, through the intervening soft parts; to estimate the size of the skull through measurements of more accessible fetal structures; and, finally, to estimate the cranial dimensions by the duration of pregnancy.

1. **From the Period of Gestation.—Dubois's Method.**—From numerous meas-

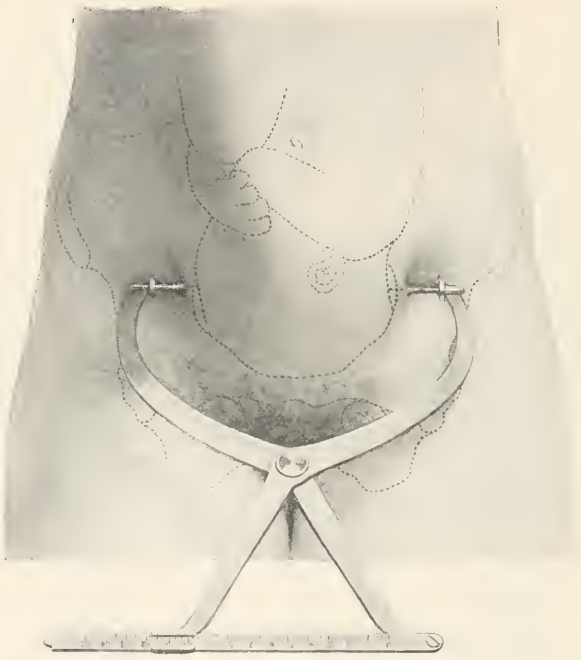

FIG. 223.—PERRET'S METHOD OF CEPHALOMETRY AND INSTRUMENT.

urements of the fetal skulls after premature deliveries, controlled by the supposed duration of pregnancy, Dubois arrived at the following relationship between the month of gestation and the biparietal diameter: seven months, $2\frac{4}{5}$ inches (7 cm.); eight months, $3\frac{1}{5}$ inches (8 cm.); eight and a half months, $3\frac{4}{5}$ inches (8.5 cm.); term, 4 inches (9 cm.). Unfortunately for this relationship, we cannot usually determine the duration of pregnancy, and therefore but little practical benefit is derived from the application of such a method to fetometry.

2. **Direct Abdominal Cephalometry.—Perret's Method** (Fig. 223).—Perret was the first to practise the measurement of the fetal head through the abdominal wall. The foundation of this method was laid in the results of craniometry of the newly born. Numerous measurements had shown Perret that whatever the length of the biparietal diameter, the occipito-frontal measurement is approximately 1

* The instrument of Neumann and Ehrenfest is made by M. Schurr, Vienna, IV Schaumburgerstrasse, No. 7a. I obtained my instrument through the Kny-Scheerer Co., New York.

inch (2.54 cm.) longer; so that if it were possible to measure the occipito-frontal diameter *in utero*, the shorter measurement could be calculated with ease. For the practice of external cephalometry, or the measurement of the occipito-frontal diameter of the fetus through the abdominal wall, the cephalometer devised by Perret is employed. This apparatus is simply a spherical compass, such as is sometimes used in external pelvimetry, but the knobs which arm the branches of a pelvimeter are replaced by a special device for overcoming the difficulties which are incident to mensuration through the thick abdominal wall (Fig. 223). Perret's description of this device is as follows*: "At the extremity of each branch is a flattened blade, so shaped as to be held readily between the fingers. These little blades revolve on their axes in slots which exist in the tips of the branches of the compass. On account of this mobility, the fingers of the operator enjoy a corresponding freedom of movement. With the fingers in position, that end of the blade which corresponds to the palmar surface and projects beyond is furnished with a convex button."

Perret's method of using his cephalometer is as follows: The woman is placed on her back, and the operator applies his hands to each side of the abdomen, just as when seeking to determine whether or not the head is engaged (Fig. 223). If engagement has occurred, the procedure must be abandoned. Otherwise the operator begins to palpate with the short movable blades (which furnish the tips of the branches of the cephalometer) the head between the terminal phalanges of the middle and ring fingers of both hands. As the palpating finger-tips locate the head, an attempt is made to press the cephalometer buttons against the forehead and occiput of the child. When this has been accomplished, the distance is read off on the scale of the apparatus.

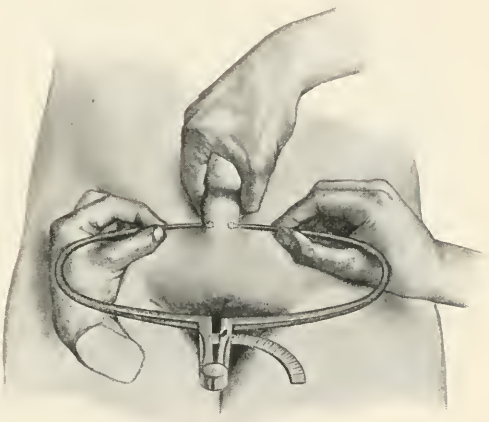

FIG. 224.—MEASURING THE THICKNESS OF THE ANTERIOR ABDOMINAL WALL.

The thickness of the abdominal wall is next measured directly, by pinching up a fold of the latter, and is deducted from the fetal measurement (Fig. 224). The result should be the occipito-frontal diameter of the child's head. If now we subtract 1 inch (2.54 cm.), we obtain the biparietal diameter. The cephalometer has been in constant use in the Tarnier clinic in Paris for a number of years. In the hands of Perret and others the results are surprisingly good, the error between the intrauterine and extrauterine measurements being insignificant in the majority of cases; so that in the hands of one specially trained, cephalometry may be termed a practical success. On the contrary, others have published series of cases in which the error was so great as to invalidate the results of the method for ordinary practice. What has thus far been said of Perret's cephalometry refers only to labor at term, the mensuration having for its immediate object the determination of disparities between the measurement of the head and pelvis. There is, however, a second and equally important indication for cephalometry in connection with artificial premature

* "L'Obstétrique," Nov., 1899.

delivery. Given the dimensions of a contracted pelvis, cephalometry should determine the maximum size of the head compatible with natural delivery, and indicate the period at which pregnancy should be terminated.

The ratio between the two cranial diameters of the fetus holds good for the seventh, eighth, and ninth months, the difference, 1 inch (2.54 cm.), being in reality the average difference of all skulls having a biparietal diameter of from 3 to $3\frac{1}{2}$ inches (7.62 to 8.89 cm.). Labor must be interrupted, of course, before the biparietal diameter becomes longer than the true conjugate. The results of Perret and others, in this department of obstetrics, appear to show that his method is of undoubted value in aiding in the choice of that moment for the interruption of pregnancy which shall be most advantageous for the interests of mother and child alike.

3. Stone's Method of Cephalometry (Fig. 225).—This is a modification of

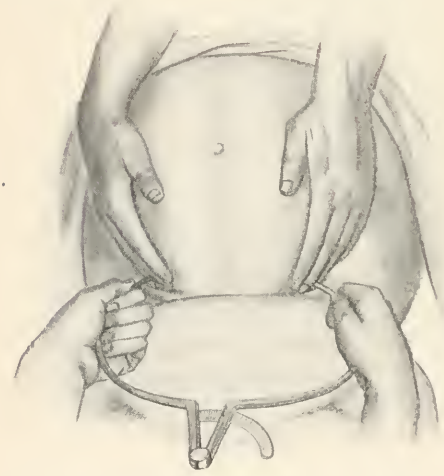

FIG. 225.—STONE'S METHOD OF CEPHALOMETRY.

FIG. 226.—DETERMINING THE CAPABILITY OF THE HEAD TO DESCEND INTO THE PELVIS. MÜLLER'S METHOD OF CEPHALOMETRY.—(*Bumm.*)

Perret's method. An ordinary pelvimeter is used, and no deduction is made for the thickness of the abdominal and uterine walls. The patient is in the ordinary dorsal posture, and the examiner standing on one side, facing the patient's feet, carefully palpates and makes out the position of the fetal head. If it is already engaged in the pelvis, it will not only be impracticable, but also unnecessary to measure it. The occipital and frontal poles are now grasped between the two hands, and an assistant places from below the ends of the pelvimeter between the terminal phalanges of the middle and ring fingers of the examiner, pushing them firmly inward as the examiner directs. An assistant or nurse is necessary to obtain the best results, in order that the examiner's fingers may be entirely free accurately to locate the fetal head (Fig. 225). From this measurement obtained, namely, the occipito-frontal diameter, is subtracted one inch (2.5 cm.), which is the average difference at the seventh, eighth, and ninth months between the occipito-frontal and biparietal diameters. Stone found the average difference

to be 2.33 cm. in one hundred measurements, and he subtracts 2 cm. for heads with an occipito-frontal diameter of less than 4.2 inches (11 cm.) and one inch (2.5 cm.) for those above this measurement. Thus fairly accurate results will be obtained and sufficient amount will be allowed for the moulding.*

4. Manual Engagement of the Head.—Müller's Method (Fig. 226).—The relations which exist between the head and pelvis may often be determined by various manual procedures. The so-called method of Müller has been brought into regular and systematic use by prominent obstetricians of Paris,

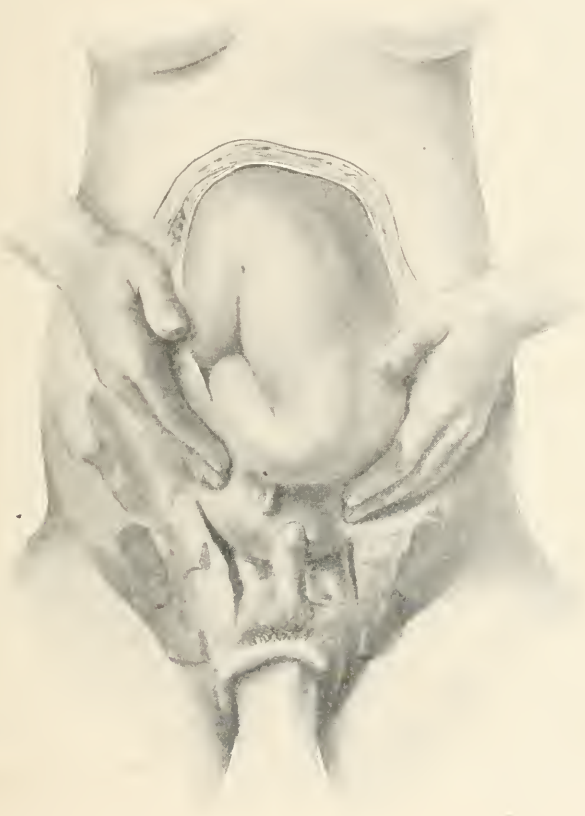

Fig. 227.—Determining any Disproportion between the Fetal Head and the Pelvic Inlet.

under the name of "*palper-mensurateur*," given it by Pinard. According to Budin, it is sufficient to make an attempt to engage the head in the pelvis, by pressure exerted through the abdominal wall, as in Hofmeier's method for securing the engagement of the head during labor. (See Labor.) After the bladder and rectum have been emptied, the accoucheur places a hand on each side of the hypogastrium (Fig. 227), the head being in relation with the inlet. Pressure is then made in the axis of the superior strait, so that the head is forced into the pelvic cavity. If this engagement can be brought about,

*W. S. Stone, "Antepartum Measurement of the Fetal Head," "N. Y. Medical Record," November 4, 1905, p. 725.

it is evident that labor should be normal. The head enters the pelvis more readily if the patient is so placed that the long axis of the uterus is vertical and at right angles to the plane of the inlet. The manœuver is disagreeable to many women, and is also difficult of execution if the abdominal walls are thick and resistant, but it renders real service, giving valuable information to the physician. I have found it more reliable to introduce the whole hand into the vagina, and with the fingers spread over the head to have an assistant exert pressure on the hypogastrium to secure engagement of the head (Fig. 227). The internal hand then estimates the relation between the size of the head and the inlet. Perret, in comparing his method of cephalometry with the "*palper-mensurateur*," states that it cannot be applied in nervous women, in cases of vicious insertion of the placenta, hydramnios, thick abdominal walls, or in any case after labor has begun. It is, of course, applicable in head presentations only. The "*palper-mensurateur*" also gives false information at times. Thus, it appears to indicate that delivery is impossible in cases in which the pelvis is normal, and failure to engage is due to trouble higher up (false lumbar promontory, tumors, etc.).

5. Internal Manual Cephalometry.—A fairly accurate estimate of the size of the fetal head may be obtained by introducing the whole hand into the vagina after full dilatation of the cervix, and grasping the head with the extended fingers, then with firm suprapubic pressure with the other hand attempting to engage head and fingers together (Fig. 227); or one can simply grasp the head as in Fig. 226, and estimate its size by palpation.

6. Röntgen Cephalometry.—As will be seen by referring to the section on Röntgen pelvimetry, recognition of pelvic anomalies is relatively simple. The great problem to overcome is the photography of the fetus. If a combined shadow of both the head and pelvis could be obtained, much light would be thrown upon the relations existing between these structures in individual cases. In 1898, Gocht* announced that photography of the fetal skeleton was impracticable. Varnier, however,† succeeded, after more than three years of effort, in obtaining a clear view of the contour of the fetal head in a woman seven months pregnant, so that he regards it as practicable to determine the size of the head, its position, degree of flexion, and manner of engagement, in the latter months of pregnancy. No shadow can be obtained of the spine and limbs, however. Varnier's‡ complete studies have not yet appeared, and although he has demonstrated to me personally in Paris the minute technique of his method, I do not feel at liberty to publish it.

XI. THE HYGIENE AND MANAGEMENT OF PREGNANCY.

Prophylaxis.—A large proportion of the women who apply to the gynecologist for relief of crippled pelvic organs owe their invalid conditions to mismanagement or avoidable accidents of the pregnant, parturient, and lying-in states. This large class of invalids, who owe their condition to careless and unclean obstetrics, can be greatly reduced, if not practically done away with, and the remedy is to be found not in the preaching, but in the practice of clean and conservative obstetrics. A careful attention to prophylaxis, on the part of the obstetrician,

* "Lehrbuch d. Röntgen-Untersuchung."

† "Ann. de Gynécol. et d'Obstétrique," April, 1889.

‡ Professor Varnier died in 1903.

is of value not only in anticipating and warding off many of the dangers of pregnancy, labor, and the puerperium, but also in preventing many subsequent disabilities of a gynecological nature. Nowhere more than here does the old maxim, that prevention is better than cure, find truer application. There is relatively little that we can do during pregnancy, which will have a direct influence in the prevention of subsequent uterine and pelvic trouble. Attention to the general health, however,—*e. g.*, the prevention of constipation, the proper treatment of coexisting anemia, moderate exercise in the open air, suitable clothing, especially the avoidance of constriction about the waist, in a word, a good hygiene of pregnancy,—is undoubtedly of prophylactic importance in two ways: (1) By providing the patient with healthy blood, one of the best of germicides, and thus, perhaps, forestalling or minimizing the effects of septic infection; (2) by increasing the muscular and general nutrition, factors of undoubted importance in the prevention of subsequent subinvolution of the uterus and adnexa. Every pregnant woman should be impressed with the importance of placing herself under the care of the physician who is to attend her, as soon as she shall become aware of her condition. It would be wise to give such a patient, early in gestation, some simple directions, either verbal or printed, embracing advice regarding exercise, clothing, diet, care of bowels, skin, kidneys, breasts, teeth, and the danger-signals of approaching complications. (See Appendix.) There can be little doubt that not only patients but their advisers are too prone to consider this a period of invalidism, and to forget that it is a physiological process. One of the important results of the former view is the neglect of muscular exercise, especially in the higher ranks of life, where the desire to escape observation, and the fears inspired by false ideas, lead to the neglect of even the little exercise—*i. e.*, walking—to which the patient is accustomed, and the consequent weakening of the whole muscular system. Now, just the opposite should be the case. The strain imposed upon the muscular system by the requirements of labor is a severe one, and should be forestalled by the cultivation, as far as possible, of muscular strength. In the effort, however, to secure a proper hygiene of pregnancy, we should not forget the danger of overexertion; and this brings us to the consideration of one point which I believe to be of especial and direct prophylactic importance. I refer to the avoidance of everything which increases intrapelvic pressure and resulting pelvic congestion.

No one who has had an extensive obstetric experience can fail to observe that a large number of pregnancies are, when carefully studied, really pathological in their nature. Witness the frequency of the toxemia of pregnancy as we understand the condition to-day, and the probable dependence of most cases of vomiting of pregnancy upon this state. (See Part III.)

Our present knowledge of the pregnant state demands that women at this time shall be constantly under the observation of a competent physician.

Pregnancy cannot be treated through the mails or over the telephone.

It is not enough that a monthly or bi-monthly examination of the urine be made for symptoms of hepatic or renal insufficiency, as such urinary analysis often fails completely to indicate the presence of toxemia.

Pregnant women should be frequently seen by their physician, and watched for general symptoms of the over-charging of the blood with toxic material—as nausea and vomiting, headache, physical and mental lassitude, high arterial tension, alterations in character and disposition.

Thus, and thus only, shall the physician do his whole duty by his patient.

Exercise.—The pregnant woman is often almost unfitted for exercise in

the early part of pregnancy, on account of the usual discomfort of "morning sickness," and in the last part by her great increase in size, at which latter time she generally lies down frequently and is disinclined to any exertion. The nausea of the early months often plays a protective rôle in pregnancy, as it demands rest on the part of the patient, who might otherwise overexert herself. Nevertheless, a moderate amount of exercise is very beneficial during the period of gestation; walking offers the most favorable form, since more violent exercise may cause much harm. Carried to the point of slight fatigue every day; exercise, especially walking, will put the woman herself, as well as her child, into the best physical condition for her approaching labor. If the patient is unable to take this kind of exercise, then the passive form obtained in carriage-driving will be found next in order of efficiency; but if this causes backache and a feeling of weight in the lumbar region it should be forbidden.

Diet.—A mixed diet, sufficient in quantity to meet the often increased appetite of the patient, is probably the best. Important modifications of diet are, of course, imperative in threatened albuminuria, vomiting of pregnancy, and other morbid conditions. (See Pathological Pregnancy.) Usually early in pregnancy there are certain digestive disturbances which, with the less active life they entail, cause a decrease in desire for food. In many cases morning sickness has been avoided, or at least lessened, by giving an early morning breakfast to the patient, after which she sleeps for an hour or two before rising. A generous, wholesome, and simple diet is demanded by the patient. Meats, vegetables, and fruits should be included. By the fourth month the gastric disorders disappear, as a rule, and appetite returns. It is well, during the last of gestation, for the patient to take several extra lunches daily, and on account of the encroachment of the enlarging uterus on the gastric space, the amount of food taken at one time should be smaller, but the intervals between meals should be shorter.

Drink.—The drink should be water, milk, or chocolate; tea and coffee may be taken in moderation, but should not be strong. Alcoholic beverages should be avoided, for the pregnant woman is especially prone to contract the alcoholic habit.

Bowels.—The bowels should be carefully looked after, and constipation is to be especially avoided. Plenty of water should be taken and the diet should look toward the alleviation of constipation. Coarse cereals, fruit, etc., encourage free movements. Enemata or mild laxatives may be added to the régime. Glycerin, soap, gluten, and cocoa-butter suppositories are useful; one or two teaspoonfuls of aromatic cascara at bedtime; tasteless fluid extract of cascara and fluid extract of licorice each a half-teaspoonful at bedtime; tablet triturates with varying combinations of aloin, cascarin, belladonna, and strychnine. The habitual use of suppositories and enemata should be avoided, as well as the sulphate of soda, mineral waters, or, in fact, the constant use of any drug, as our object should be to secure proper action of the bowels by attention to the diet and the free use of water. Most pregnant women are benefited by an occasional dose of a mercurial at bedtime, followed by a saline or sulphur water in the morning. (Compare Constipation, under "Pathological Pregnancy.")

Fresh Air.—Plenty of outdoor air is essential to the patient. The gravid woman is eliminating an increased amount of carbonic acid, as she is breathing for two. Crowded rooms should be sedulously avoided, and all impure air, sewer-gas, etc., excluded. There must be thorough ventilation of the rooms occupied both by night and day.

Care of the Skin.—The skin should play its full part as an eliminating organ,

especially in the last part of pregnancy, as the kidneys must be relieved as far as possible of extra work. Bathing should be continued according to the patient's habits before pregnancy. Reaction may be secured by friction with a coarse towel. Hot and cold baths, however, or any shock,—for example, that incident to sea-bathing,—should be avoided. Tepid vaginal douches are often a source of great comfort.

Clothing.—Clothing should be well adapted to the condition. Corsets are to be laid aside; low-heeled shoes are to be preferred; it is well to suspend the weight of the garments from the shoulder-straps. The clothes should weigh as little as possible and be loosely fitted. Circular garters ought to be replaced by side supporters. It is well to recommend warm drawers as soon as the enlarging abdomen lifts the skirts from the thighs. If the abdomen is very lax and pendulous, a suitable binder may well be applied for support. It should aim to lift the weight from below and exert no pressure. One of the best abdominal supporters is a French maternity corset (Figs. 228 and 229), which combines support of the lower abdomen with that of the breasts. I had this corset imported several years ago, and have used it in my practice, with much satisfaction to my patients.*

Leucorrhea.—In the case of leucorrheal discharge, vaginal douches may be necessary, and bathing and care of the external genitals are absolutely demanded for the comfort of the mother. Local treatment, if demanded, can be applied without harm, with proper precautions. (See Part III.)

Breasts.— There must be no pressure on the mammary glands, and they must be warmly covered. The nipples particularly must be kept scrupulously clean. The physician should make an examination of these organs a month before labor, when any abnormalities, such as abrasions, fissures, milk scabs, etc., can be treated. If the nipples are retracted, they may be drawn out gently every day by the patient herself. Some believe in the daily exposure of the nipples to the air, in order to render more active the epidermic secretion. To prevent sore nipples during lactation, I am accustomed to instruct my patients to carefully draw out each nipple daily, in the last few weeks of gestation, with absorbent cotton moistened with an oily astringent, such as compound tincture of lavender, two ounces, and glycerin, half a drachm. (For breast supporters, see Pathological Puerperium, Part VII.)

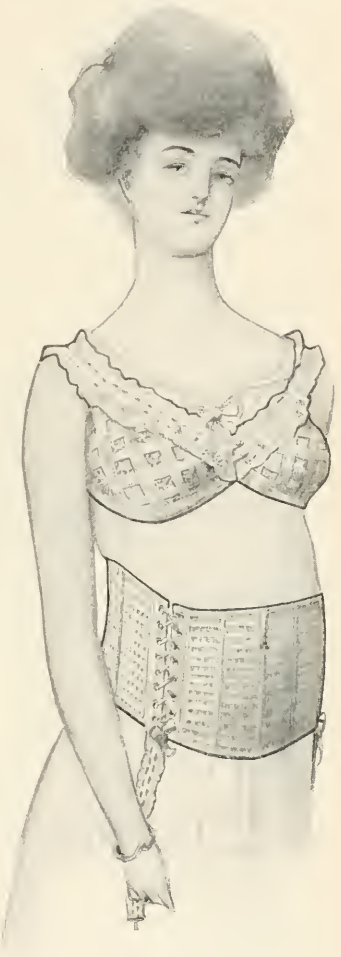

FIG. 228.—AN IMPROVED MATERNITY CORSET FOR SUPPORT OF THE LOWER ABDOMEN AND BREASTS IN THE LATTER WEEKS OF GESTATION. ANTERIOR VIEW.—(*From a photograph taken at the Emergency Hospital.*)

* This maternity corset is now made in this country for me by Mrs. Leighton, 3 East 41st Street, New York city.

Mental Condition.—Mental depression and excitement should be guarded against. Anxiety should be quieted, kind assurances and encouragement should not be spared. The patient should be guarded from all petty worries and troubles, as well as from shocks or surprises. Judicious amusement should be provided, and she should be surrounded by cheerful and agreeable companions, while her mind should be occupied by some pleasant and congenial occupation. The influence, moral, mental, physical, of the mother on the fetus *in utero* is a subject so vast and complex that its depths have never yet been sounded. Great allowance should be made for the whims and irritability of the pregnant woman, as she is often not responsible for her altered temper. Many changes in her are probably due to the alterations, both quantitative and qualitative, in her blood at this time, as well as to the changes taking place in her sexual organs. So she should be humored and shielded, and her idiosyncrasies should be gently overlooked.

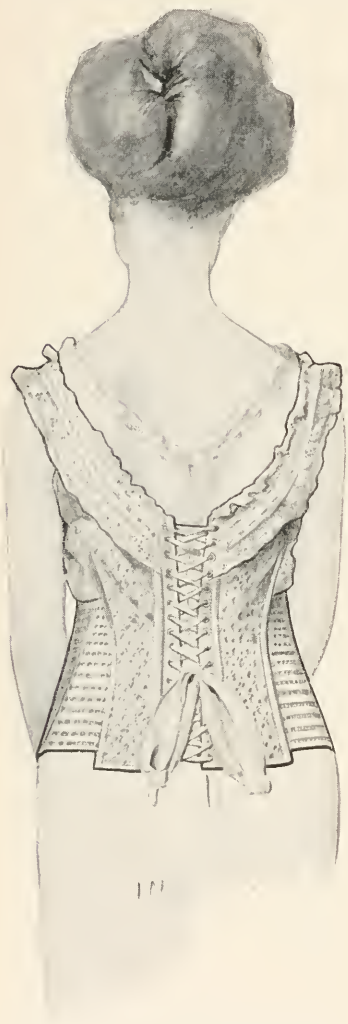

FIG. 229.—AN IMPROVED MATERNITY CORSET FOR SUPPORT OF THE LOWER ABDOMEN AND BREASTS IN THE LATTER WEEKS OF GESTATION. POSTERIOR VIEW.—(*From a photograph taken at the Emergency Hospital.*)

Examination of the Urine.—From the third to the seventh month, monthly examinations of the urine should be made; from the seventh to the ninth month, every two weeks, and then once a week till labor begins. The patient should be warned to make an immediate report of any decrease in the amount of urine excreted in the twenty-four hours. The examination should take account of the twenty-four hours' amount, the specific gravity, the quantity of urea and its variation, intestinal or hepatic toxemia, and the presence of albumin and casts. Through this constant watch for symptoms of toxemia many cases of eclampsia may be avoided. (See Toxemia of Pregnancy.)

Sexual Intercourse.—The subject of marital intercourse during pregnancy has received much attention. Many and diverse opinions have been expressed, but it is generally considered that during the first months of pregnancy, and at the last, sexual intercourse should be forbidden. To most pregnant women it is distasteful, although in others the sexual appetite is increased. It often causes great pelvic discomfort. It should in any case be forbidden at those times which correspond with the menstrual epochs, as then pelvic congestion and a special tendency to abortion exist. Sexual intercourse is held to be one of the most influential factors in producing abortion and systemic disturbances.

The possibility of infection of the uterus during coitus from germs beneath the foreskin cannot be denied. This is especially liable to occur in a case of placenta prævia.

PART THREE.

Pathological Pregnancy.

I. DISEASES OF THE DECIDUÆ. (Page 191.) 1. Acute Infectious or Exanthematous Deciduitis. 2. Acute Hemorrhagic Deciduitis. 3. Acute Purulent Deciduitis. 4. Chronic Catarrhal Deciduitis, Endometritis Gravidarum Catarrhalis, Endometritis Deciduæ Catarrhalis. 5. Chronic Diffuse Hyperplastic Deciduitis, Endometritis Deciduæ Chronica Diffusa, Endometritis Gravidarum Hyperplastica. 6. Chronic Tuberous or Polypoid Deciduitis. 7. Chronic Cystic Deciduitis. 8. Apoplexy of the Decidua. 9. Atrophy of the Decidua. 10. Deciduoma. 11. Chorio-epithelioma Malignum.

II. DISEASES OF THE CHORION. (Page 198.) 1. Cystic Degeneration of the Chorionic Villi; Hydatidiform or Vesicular Mole; 2. Fibromyxomatous Degeneration of the Chorion. 3. Chronic Choriitis.

III. ANOMALIES OF THE AMNION AND LIQUOR AMNII. (Page 201.) 1. Plastic Exudation, Amniotitis. 2. Abnormal Tenuity. 3. Cysts and Dermoids. 4. Premature Rupture, Amniotic Hydrorrhea. 5. Anomalies in Color and Composition of Liquor Amnii. 6. Oligohydramnios. 7. Hydramnios.

IV. ANOMALIES AND DISEASES OF THE PLACENTA. (Page 208.) 1. Anomalies.—(1) Size: (a) Atrophy; (b) Hypertrophy; (c) Placenta Membranacea. (2) Form. (3) Number. (4) Relation. (5) Insertion: Placenta Prævia. 2. Injuries.—Premature Detachment. Accidental Hemorrhage. 3. Stasis and Œdema. 4. Interstitial Hemorrhage.—Apoplexy. Infarction. Thrombosis. 5. Placentitis.—(1) Acute Septic, (2) Gonorrheal, (3) Emanuel's Disease. (4) Specific; (5) Chronic Interstitial and (6) Albuminuric. 6. Infectious Granulomata.—Tuberculous and Syphilitic. 7. Secondary Metamorphoses.—(1) Progressive. Hyperplastic and Sclerotic. Adherent Placenta. (2) Regressive. Results of Fetal Death. White Infarcts. Cystic, Calcareous, Fatty, and Miscellaneous Degenerations. 8. Tumors.—Placentomata. Polypi.

V. ANOMALIES OF THE UMBILICAL CORD. (Page 237.) 1. Length. 2. Thickness. 3. Insertion. 4. Coils. 5. Knots. 6. Tangling. 7. Torsion. 8. Stenosis of the Vessels. 9. Cysts. 10. Calcareous Deposits. 11. Hernia. 12. Syphilis. 13. Obstruction of the Vessels. 14. Dilatation of the Umbilical Vein. 15. Hypertrophy of the Valves. 16. Congenital Tumors.

VI. DEFORMITIES AND MONSTROSITIES OF THE FETUS. (Page 244.)

VII. ANTENATAL DISEASES OF THE FETUS. (Page 255.) 1. Infectious Diseases. 2. Acute Poisoning. 3. Chronic Poisoning. 4. Dyscrasic Conditions. 5. Cardiac Diseases. 6. Diseases of the Alimentary Tract. 7. Diseases of the Nervous System. 8. Diseases of the Urogenital Apparatus. 9. Skin Diseases. 10. Bone Disease. 11. Traumatisms. 12. Neoplasms. 13. General Œdema. 14. Maternal Traumatisms. 15. Maternal Uterine Disease Affecting the Fetus. 16. Fever in the Mother Affecting the Fetus. 17. Death of the Mother Affecting the Fetus.

VIII. DEATH OF THE FETUS. (Page 272.) 1. Maceration. 2. Mummification. 3. Absorption. 4. Putrefaction. 5. Saponification. 6. Calcification.

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Pathological or abnormal pregnancy is one in which some departure from a physiological pregnancy occurs in mother, ovum, embryo, or fetus. Although the vast majority of pregnancies are normal, still it must be remembered that in all classes of mankind the departures from the normal standard in ancestors and parents, with their accompanying physical imperfections, latent or obscure though they may be, will show themselves in even more pronounced and dangerous forms in the pregnant woman and the fetus *in utero*. The influences upon the present and subsequent generations of years of improper hygienic environment and nutrition, with their resulting faulty development of muscle and bone, and reflex neuroses must never be lost sight of in the examination of pregnancy.

I. DISEASES OF THE DECIDUÆ.

1. Acute Infectious or Exanthematous Deciduitis. 2. Acute Hemorrhagic Deciduitis. 3. Acute Purulent Deciduitis. 4. Chronic Catarrhal Deciduitis, Endometritis Gravidarum Catarrhalis, Endometritis Deciduæ Catarrhalis. 5. Chronic Diffuse Hyperplastic Deciduitis, Endometritis Deciduæ Chronica Diffusa, Endometritis Gravidarum Hyperplastica. 6. Chronic Tuberous or Polypoid Deciduitis. 7. Chronic Cystic Deciduitis. 8. Apoplexy of the Decidua. 9. Atrophy of the Decidua. 10. Deciduoma. 11. Chorioepithelioma Malignum.

Introduction.—The decidua is the transformed endometrium, and it is subject to any of the diseases that may attack the non-gravid uterine mucous membrane; but in the case of pregnancy these affections are apt to assume a severe grade, owing to the great hypertrophy of the tissue concerned. The results are apt, also, to be more serious, on account of the relation to the fetus. Endometritis, so called, is generally not inflammatory, so the term, as often applied, is a misnomer. These diseases are of several forms.

1. Acute Infectious or Exanthematous Deciduitis.—As its name implies, this is generally a result of the acute infectious diseases, although it may be an extension of an inflammation from the endometrium before pregnancy. Ahlfeld declares that the cervix is nearly always infected first, and this can be clearly seen if the decidua serotina lies near the cervix, as in placenta prævia. Of great interest are the eleven cases of Klotz, which show the effect of measles on pregnancy. Nine of these suffered from abortion, at a time which seemed to show a direct connection between the expulsive efforts of the uterus and the breaking-out of the eruption on the skin. Klotz believes that the uterine contractions are caused by the irritation of the exanthem as it occurs on the mucous membrane of the uterus. This disturbance is analogous to the photophobia, coryza, bronchitis, and vesical tenesmus, which are the expression of the effect of the same irritating cause upon other mucous membranes. The same explanation would probably hold good for abortions occurring in any of the eruptive fevers. This condition consists in active inflammatory changes, which may involve only small foci or the entire decidua.

2. Acute Hemorrhagic Deciduitis.—In deciduæ may often be found old and fresh extravasations of blood between the villi. In one variety tuberosities form, much like those seen in the tuberous decidua. If the extravasation continues after the death of the fetus, there is finally formed what is known as a "fleshy mole." This structure conforms to the shape of the uterine cavity, and consists of various layers of blood of different hemorrhages, held together by means of the atrophied villi. In the center of this mass we usually find the empty amniotic cavity, but at times the macerated fetus is present. (Compare Pathology of Interrupted Pregnancy.)

3. Acute Purulent Deciduitis.—This condition is very rare. The case described by Donat shows the state of the structures concerned. This patient expelled at term a placenta which was surrounded by a margin of decidual tissue infiltrated with pus. Between the amnion and chorion, which were both thickened and opaque, was a mass of purulent liquid. This condition probably resulted from an unsuccessful abortion attempted by the woman herself. Various explanations have been offered to clear up the nature of the case. Donat himself thinks that the pus made its way from the decidua through the chorion, collecting between the latter membrane and the amnion. Careful macroscopic and microscopic examinations were made, dispelling all doubt about the case. Hirst suggests that the pus might have been originally expressed from a distended tube. Thence it may have forced its way through the ovular decidua, or, if earlier in pregnancy, through the layers of the membranes. This last theory seems quite plausible, in consideration of the recent work done on hydrorrhœa ovarialis intermittens, in which affection there is a periodic discharge from the tube into the uterus.

4. Chronic Catarrhal Deciduitis; Endometritis Gravidarum Catarrhalis; Endometritis Deciduæ Catarrhalis; Hydrorrhœa Gravidarum.—*Definition.*—This is a chronic inflammation of the decidual endometrium, probably arising from some obscure morbid condition of the mucous membrane.

Pathology.—Many theories have been advanced to explain this rare condition. It may arise from a hypertrophy of the glands, whose openings are not obliterated; and, as a result of this state of chronic glandular inflammation, a clear viscid liquid is poured out between the decidua and chorion, whence it makes its escape to the os uteri. The secretion varies greatly in quantity; in one reported case, from one-half to three-quarters of a liter was lost each time. Some believe that the secretion comes from the bursting of a cyst which is formed between the ovum and the uterine walls; others, that it is a transudation of the liquor amnii through the membranes. Another suggestion is that the liquid escapes from an opening in the membranes at a distance from the os uteri; still another, that the liquid comes from a sac between the amnion and chorion. In these last cases there may be only one gush of the liquid contents; but if the discharge is a continuous one, or repeated intermittently, none of these theories will hold good. This affection occurs in the first part of pregnancy, before the reflexa joins the vera; if, however, this union does not take place, the discharge may continue throughout pregnancy.

Symptoms.—The fluid, which is of a pale yellowish color and transparent, may escape from the vagina by dribbling, or by one sudden gush. It may escape from time to time for weeks, and in such quantity as to soak the clothing of the patient.

Diagnosis.—If a physician is called to such a case, and is told that there has been an escape of waters, he is apt to think that the membranes have been ruptured. In hydrorrhea there are no pains, the cervix is not dilated, and

ballottement can be obtained. If after the watery discharge pregnancy continues as before, the diagnosis of hydrorrhea may be established. Pregnancy often continues to term with no untoward phenomena.

Differential Diagnosis.—Hydrorrhœa gravidarum is distinguished from incontinence of urine also by the nature of the secretion, and by the absence of urea and of acid reaction. Endotrachelitis and colpitis are excluded by inspection, and by the absence of pus. Pus may occur, however, if the disease is accompanied by an endometritis.

Prognosis.—In general, the prognosis is good for both mother and child, as the pregnancy is not compromised by the disease. The child should be born at term and in good condition. If other causes of abortion are operative, the gestation may of course be interrupted. When the discharge is continuous and of a dark hue, the case may not go on to term.

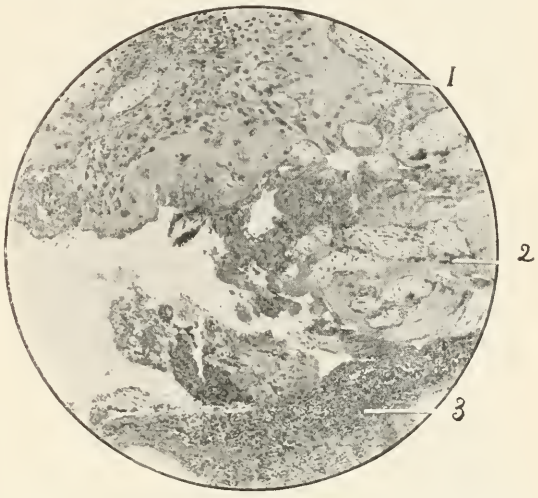


FIG. 230.—DECIDUAL ENDOMETRITIS. 1, Decidual tissue; 2, fetal villi; 3, layer of pus. (× 250 diameters.)—(*From a specimen in the Pathological Laboratory of the Cornell University Medical College.*)

Treatment.—The management is comprised in the prophylaxis of abortion. The woman should be kept recumbent, even in cases of moderate degree. Opiates should be administered if uterine contractions are present.

5. Chronic Diffuse Hyperplastic Deciduitis; Endometritis Deciduæ Chronica Diffusa; Endometritis Gravidarum Hyperplastica.—*Definition.*—Instead of the atrophy of the uterine mucous membrane that normally takes place in the latter part of pregnancy, the condition of hyperplasia that existed in the first part continues to increase (Fig. 230).

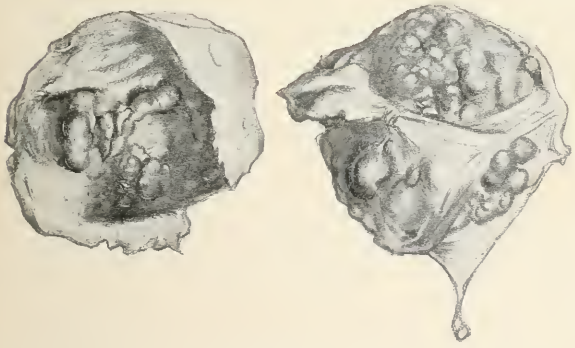


FIG. 231.—DECIDUA TUBEROSA FROM AN ABORTION.—(*Ahlfeld.*)

Pathology.—This steady progression, which affects both layers of the decidua, results in a membrane $\frac{1}{8}$ or $\frac{1}{6}$ inch (3 or 4 mm.) in thickness. The cells increase in size, and have larger, more vesicular nuclei. The tissue looks like that of a sarcoma, and has been described as such. If the disease makes rapid strides, abortion will generally occur as a result of hemorrhages into the mucous membrane, which separate it from the wall of the uterus. Or it may occur from the death of the fetus, whose nourishment has all been diverted to the increase of

the decidua. The embryo may be absorbed, and the decidual membranes afterward discharged as an empty sac with very thick walls, in which case it constitutes one variety of the fleshy moles. (See Abortion.) Or the embryo may be destroyed by hemorrhages into the abnormally developed decidua, the blood forcing its way through all obstructions into the cavity of the ovum. In this condition only microscopic examination will reveal the true character of the tissues.. New-formed muscle-fibers have been seen in the hypertrophic tissues. The *etiology* of this affection is generally an antecedent morbid condition of the mucous membrane, which the presence of the fecundated ovum excites to abnormal proliferative activity. The morbid condition is actually a chronic endometritis, either simple, syphilitic, or gonorrheal. Similarly, the death of the embryo, or some disease of the latter, may excite the previously healthy mucous membrane to overgrowth.

Prognosis.—The danger to the mother lies in the frequent retention *in utero* of remnants of the placenta, which are not expelled with the rest of the ovum. Frequently the decidua over the placental site is retained, giving rise to hemorrhages or septicemia. This condition has been described under various names by different authorities.

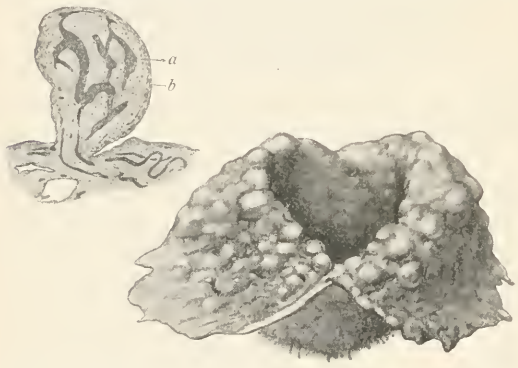


FIG. 232.—POLYPOID DEGENERATION OF THE DECIDUA VERA. The upper figure is a section of one of the polypoid growths enlarged, showing blood-vessels at *a* and decidual cells at *b*.—(*Veit.*)

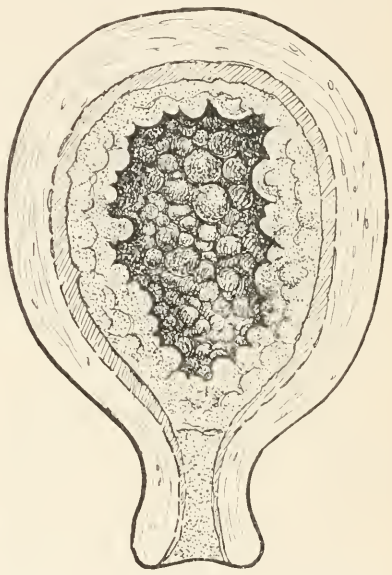


FIG. 233.—TUBEROUS SUBCHORIAL HEMATOMATA OF THE DECIDUA.—(*Walther.*)

6. Chronic Tuberous or Polypoid Deciduitis.—This disease of the decidua was first described by Virchow, who thought it syphilitic in origin, since his case exhibited a syphilitic history (Figs. 231, 232, and 233). Later work, however, shows no evidence that the disease is due to syphilis, and no assignable cause has thus far been discovered.

Pathology.—This is a hyperplastic affection, and corresponds to hyperplasia in the non-pregnant condition, so that the etiology of this form of deciduitis must be traced to a pre-existing chronic endometritis. The disease belongs to early ova, and quite often the chorionic villi are seen to have undergone myxomatous degeneration. Schroeder states that in all the cases so far described, abortion has occurred between the end of the second month and the beginning of the fourth. Ahlfeld says that this condition is frequently seen in aborted ova. The internal surface of the decidua is studded with villus-like

projections, which measure half an inch (1.25 cm.) or more in height (Fig. 232). They are polypoid nodules or cones, very vascular, and possess a smooth surface. Between these nodes may be seen the openings of the glands, which do not appear at all upon the projections. The entire membrane is much thickened, and consists of proliferated connective tissue, and hypertrophy of the decidual cells, with enlargement of the nuclei. Although the surface is by some described as smooth, others characterize it as rough and covered with coagulated blood. Bulius, of Freiburg, has done much work in this field. Sections show decidual cells with a little glandular tissue. The fibrous bundles of connective tissue constrict the gland openings and blood-vessels. Yet, in spite of this, the entire decidua is extremely vascular.

7. Chronic Cystic Deciduitis, or Endometritis Deciduæ Cystica (Fig. 234).—This affection is rare, but has been observed by Hegar and Breus. It resembles the last form, endometritis polyposa, except that the fibrous elevations are not masses of decidual cells, but consist of cystic gland cavities which contain liquid. They are retention-cysts, formed by occlusion of the glands of the uterine ducts. This condition is found only in very young ova. It might occur in the first stages of chronic hyperplastic decidual endometritis, in which the advancing disease destroys and later obliterates the glands. About the retention-cysts the connective tissue is hypertrophied, and embryonal elements are also found, together with an increase in decidual cells.

FIG. 234.—CYSTIC DEGENERATION OF THE DECIDUA VERA.—(*Breus.**)

Treatment of Decidual Inflammations.—In pregnancy the treatment of these chronic forms of endometritis is impossible, the only resource being to use prophylaxis, by treating the antecedent chronic endometritis that is almost invariably present.

8. Apoplexy of the Decidua.—We have alluded to this subject under hemorrhagic endometritis. The great vascularity of the deciduæ and the delicacy of the walls of the vessels predispose these tissues, under the influence of mild traumatism, to effusion of blood, with resulting abortion. Apoplexy of the decidua occurs most frequently during the first two months of pregnancy. The blood collects both within and between the membranes. The effusion of blood may extend through the entire thickness of the deciduæ (Fig. 235).

If abortion occurs directly after the effusion of blood, the whole mass discharged is known as a "blood" or "sanguineous" mole (*mola sanguinea*). But if this expulsion occur at a later period, there is time for the organization of blood-clot, which gives a curious raw-beef appearance to the mass, which is then called a "carneous" or "fleshy" mole (*mola carnosa*). (See Abortion.) If a deposition of lime salts take place in the clots, as it rarely does, there is formed a "calcareous" or "stone" mole. Pregnancy coming to an end in this manner is called a false or molar pregnancy, and the product is known as a "blighted" ovum.

The *etiology* of apoplexy of the decidua consists in traumatisms of various kinds: injuries, blows, repeated congestions from too frequent coitus; also

* "Arch. für Gyn.," Bd. XIX, S. 486.

Bright's disease, the deciduæ sharing in the general tendency to congestion characteristic of this disease.

The *treatment* is simply that of abortion.

9. Atrophy of the Decidua.—In rare instances the deciduæ atrophy instead of undergoing hypertrophy and hyperplasia (Fig. 236). Hegar, Matthews Duncan, Spiegelberg, and Priestley have described this condition. The uterine, ovular, or placental decidua may participate in this change either singly or together. If the uterine mucosa is affected, the ovum does not find a sufficient resting place in the uterine fundus. It stays in its normal site until it becomes too heavy for the decidual attachments. These it gradually pulls into a long, slender pedicle, which lodges in the cervix. It increases in size till it causes reflex contractions of the cervix, being in this manner expelled from the uterus. This is the cervical pregnancy of Rokitansky. If the ovular decidua is affected, there is lacking the outermost membrane of the ovum, which consequently may rupture and its contents be expelled from the uterus.

10. Deciduoma.—Neoplasms of the decidua are very rare. Two varieties have been described, one of which is non-malignant and the other malignant. Deciduoma consists of the remains of decidua which have undergone hyperplasia. The chief symptoms are hemorrhage, a leucorrheal discharge which is fetid and profuse, with now and then fragments of decidual tissue. There are elevated temperature, chilly sensations, and prostration, showing a certain amount of toxemic disturbance. There is only an insecure attachment between the tumor and the uterine wall. The growth should be thoroughly removed by the curette. Quinine, ergot, and stimulants are indicated internally.

FIG. 235.—FLESHY MOLE (MOLA CARNOSA).—(*Ahlfeld.*)

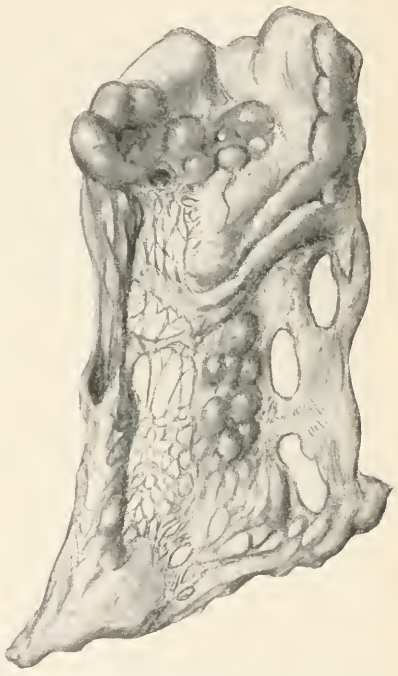


FIG. 236.—ATROPHY OF THE DECIDUA VERA.—(*Ahlfeld.*)

11. Chorio-epithelioma Malignum.—*Definition.*—A malignant uterine neoplasm originating from the decidual tissues, but manifesting itself only after the termination of pregnancy, whether by mole-formation, abortion, or full-term delivery, and including ectopic pregnancy.

Pathology.—These growths have been regarded respectively as deciduomata and syncytial growths of malignant nature, sarcomata, epitheliomata, and car-

cinomata, but at present the consensus of opinion is that they represent an epithelioma of the chorionic tissue. The destructive vesicular mole, while at times resembling chorio-epithelioma, is held to be a different condition, but transition forms occur in which differentiation is impossible.* In cases in which the destructive mole has completely invaded the uterus, the veins of the latter may be occluded, and bits of villi entering the circulation may cause metastases in the lungs. In chorio-epithelioma, on the other hand, the metastases are numerous and varied in site; not only the lungs, but the brain and viscera may be affected. Local metastases in the vagina and vulva also occur. As already stated, however, transition forms are encountered which render hard and fast distinctions difficult or impossible.

A striking feature of true chorio-epithelioma is that it may consist of metastases alone, *i. e.*, a primary focus in the uterus may not be demonstrable. Another not less remarkable fact is an analogous condition in the male, in which embryonal tumors in the testicle not only resemble deciduoma in the parturient female as to structure, but are attended with similar metastases. This fact has led to the belief that the process must be something more than an accident of maternity.

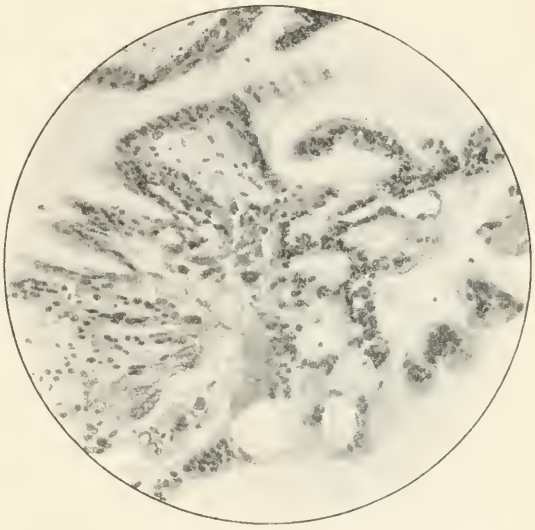


Fig. 237.—Syncytioma Malignum. This photograph shows the tip of a fetal villus covered with strands and masses of neoplastic syncytium. (× 200 diameters). (*From a specimen in the Pathological Laboratory of the Cornell University Medical College*).

The elements of the chorio-epithelioma are derived from the epithelium of the chorionic villi alone, or from both the epithelium and stroma. In typical forms the original arrangement of the chorionic elements is presented, while in atypical forms it is lost. All transitions between the two forms may occur. In the typical form, the morbid process is expressed by a distinct tumor-formation, while in atypical forms we see rather a diffuse infiltration of the neighboring tissues by the chorionic elements. In both forms the proliferating cells have the property of causing the formation of fibrin—a phenomenon also to be seen in the normal placenta and in vesicular mole.

Symptomatology.—Chorio-epithelioma, when typical, usually begins as a small tumor in the uterine cavity, save in those cases in which a primary lesion cannot be demonstrated. In such cases the process is probably atypical, the infiltrating chorionic cells passing into the circulation without the formation of a nodule. Under such circumstances, the first lesion noted may be a secondary vaginal nodule. Naturally, we find no symptoms during pregnancy, and unless we are dealing with a uterine mole, we do not find any clinical association of the disease with the post-gestational period. The local metastases, *i. e.*, those connected with the birth tract, should appear first, in the form of nodular growths in the vagina or vulva; but these appear so long after the termination of preg-

* Risel, "Ueber das maligne Chorio-epitheliom," Leipzig, 1903.

nancy that they hardly belong to obstetric practice. Symptoms of visceral metastases depend upon the vital organs chiefly attacked (lungs, brain, etc.). In case of numerous metastases death occurs under the usual picture of general malignancy, as seen in the metastatic sarcoma and cancer.

Diagnosis.—This is based on microscopic study of the vaginal and vulval tumors; in their absence, the expulsion of a mole or an atypical uterine hemorrhage should be regarded with suspicion, and the uterus should be curetted and its scrapings examined.

A differential diagnosis between chorio-epithelioma and destructive vesicular mole is hardly demanded.

Treatment.—Since the metastases are often limited to the lower genital passages, these growths should always be extirpated at once. If the uterus appears healthy and yields no scrapings suggestive of malignancy, hysterectomy may not be indicated, as a primary uterine tumor has probably failed to form. But while recovery has often occurred under these circumstances, hysterectomy done upon exact indications usually fails to save life. Hence, there must be transition cases in which the indications for hysterectomy cannot be laid down. Spontaneous recovery from chorio-epithelioma has been recorded a number of times.

II. DISEASES OF THE CHORION.

1. Cystic Degeneration of the Chorionic Villi. Hydatidiform or Vesicular Mole. 2. Fibromyxomatous Degeneration of the Chorion. 3. Chronic Choriitis.

1. Cystic Diseases of the Chorion.—*Synonyms.*—Hydatidiform, Hydatiform, Hydatoid, Placental, Vesicular, or Cystic Mole; Uterine Hydatids; Cystic disease of the ovum; Hydatidiform or myxomatous degeneration of the chorionic villi; Cystic degeneration of the villi of the chorion; Dropsy of the villi of the chorion; Molar pregnancy.

Definition.—This disease consists in a cystic formation at the ends of the villi, giving them the appearance of berries or grapes (Fig. 240).

Frequency.—The disease is very rare; Madam Boivin, of Paris, found it but once in 20,000 cases. I have seen it four times in 15,000 cases of labor observed in hospital and private practice. It is oftenest found in multiparæ, especially between the ages of twenty-five and forty. It is characterized by the tendency to recur in the same patient in subsequent pregnancies. Mayer has reported eleven cases of this disease in one patient. Hydatidiform mole develops usually in the first few months of pregnancy, and very rarely after the fourth month. When occurring within the first four weeks, death of the fetus rapidly follows, in some cases with complete absorption. If the development is later, in the second or third month, the fetus, although it may die, may be saved, if too much of the membranes and placenta is not involved. If the death of the fetus does occur at this period, there is rarely complete absorption. As has been stated, the disease is far more common in the latter part of the woman's sexual life; according to some authorities, 22 per cent. are found between the ages of forty and sixty.

Pathology.—In the formation of this growth, the syncytium and Langhans' layer of cells play a most important rôle, and appear to give the first impulse toward the changes in the villus. Large masses of syncytium and chorionic epithelium bore their way into the uterine walls, suggesting a

malignant growth (see Chorio-epithelioma Malignum). Not only do the epithelial cells proliferate, but also the connective tissue with its vessels. The resultant translucent vesicles contain a fluid closely resembling the liquor amnii, and in size they range from that of a millet-seed to a walnut. The mass *in toto* may grow as large as a man's head, absorbing the nourishment intended for the fetus, which usually dies, while the mole develops over the whole surface of the chorion (Fig. 240). The arteries of the degenerated villi become obliterated, with destruction of the decidua. Uterine pains begin, as a rule, in the fourth or fifth month. At times the mass is so intimately connected with the uterus that its expulsion is very difficult. Sometimes the growth erodes the great blood-vessels, causing fatal hemorrhage. The vesicles possess the same form as do the elements of the original chorion of the first two months, and this accounts for the peculiar grape- or berry-like appearance of the tumor-mass. Either the whole surface of the chorion is covered with these cysts, which replace the villi, or only the placental region is affected. The former happens when the mole forms in early pregnancy, before the development of the placenta; and the latter if the mole does not develop till after the placenta. In the first case the fetus naturally perishes; in the second, it may come to maturity.

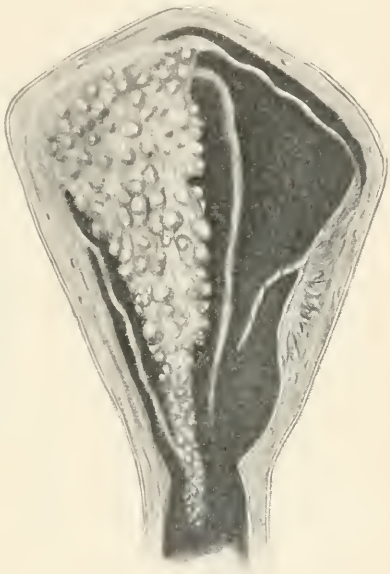


Fig. 238.—Cystic Chorion in Twin Pregnancy. Hemorrhage During Labor.—(*Bensinger.*)

Diagnosis.—This can be made to a certainty only by palpating the cysts. They may be felt during hemorrhage when the cervix dilates somewhat. There is no reason to doubt the invariable association of this disease with pregnancy. Mistakes have sometimes been made by confusing true hydatid cysts which have been discharged from the uterus, with the little bladder-like growths of the mole. Hewitt has reported a case in which hydatids, which were originally in the liver, had extended to the peritoneum, and were just at the point of bursting through the vagina at the time of the patient's death. It must also be remembered that hydatids may be retained in the uterus for a long time, and then be discharged; or a few are left behind that may give rise to a new set of growths, and these be extruded long after impregnation. When true hydatids obscure the diagnosis, it can always be cleared up by microscopic revelation of the characteristic heads and hooklets of the echinococcus.

Etiology.—The essential cause is not yet determined. Marchand thinks it most probable that the condition is due primarily to a change in the ovum, an argument being the coexistence of a normal ovum and a mole. In cases of twins, one may be perfectly healthy, while the other is affected (Fig. 238). Some ascribe the cause to disease of the mother; the arguments for this theory being the occurrence of a mole several times in the same woman, and its frequent association with uterine fibroids, cancer, or syphilis. Virchow believed it to be due to endometritis. As already stated, it seems most prone to affect older women. Other causes assigned are pre-existing metritis, chronic deciduitis,

uterine fibroids, maternal syphilis or carcinoma, absence or deficiency of allantoic vessels, fetal syphilis or other disease, fetal death (Gierse, and Grailly Hewitt).

Symptoms and Clinical History.—At first there is nothing to call attention to the existing disease, and it is only with the advancement of pregnancy that the characteristic symptoms appear. Three symptoms are most characteristic of this peculiar disease: (1) The uterus enlarges far more rapidly than in pregnancy. (2) Hemorrhage occurs, small in amount, or diffuse, irregular, varying in duration from several hours to as many weeks. These hemorrhages become more severe as the vesicles grow into the decidua, and consist of watery and sanguineous discharges, which have been likened to currant-juice in appearance.

FIG. 239.—CYSTIC CHORION PERFORATING THE WALLS OF UTERUS. — (*Spiegelberg.*)

FIG. 240.—CYSTIC DISEASE OF THE CHORION. HYDATIDIFORM MOLE.—(*Photograph of the author's specimen.*)

They are probably caused by the breaking-down of the cysts, which result from painless uterine contractions. The great increase in size of the uterus is not apparent till the third or fourth month. (3) There is a cystic or doughy feel on palpation, while the outlines of the fetal tumor are very obscure, and no fetal heart sounds can be heard. The hemorrhages may be frequent and profuse, or one attack may prove quickly fatal. When the cysts are found in the vaginal discharge the diagnosis is certain. They are whitish, sago-like bodies, generally surrounded by small blood-clots. There are numerous reflex symptoms resulting from the enlarged abdomen; viz., excessive nausea, vomiting, faintness, even syncope, and abdominal, lumbar, or sacral pains. Extreme exhaustion may develop. The abdominal pains may possibly be caused by the growth of the vesicle into the uterine substance (Fig. 239). Renal insufficiency and albu-

minuria are not uncommon. When the cystic change extends to involve the uterine wall, the disease assumes a semi-malignant character, and septic peritonitis and death may result from perforation of the uterus. The lower third of the uterus is tense. Ballottement is obscure.

Prognosis.—The patient rarely goes to term, and the fetus is generally destroyed, often completely absorbed. The maternal mortality is 13 per cent. The causes of maternal death are hemorrhage, septic infection, and uterine perforation with peritonitis. Generally the fourth or fifth month of pregnancy sees the expulsion of the ovum, which is favored by the unusual growth and consequent overdistention of the uterus, as well as by the irritation caused by the penetration of the uterine substance. Rarely, a group of cysts may be extruded without interrupting the course of pregnancy. Cancer of the uterus may result (See Chorio-epithelioma Malignum.)

Treatment.—After the condition is discovered the uterus should be emptied in order to prevent infiltration of the uterine wall by the syncytium. The cervix may be dilated if necessary by any of the approved methods and the growth removed by the fingers or curette. The latter should be carefully used on account of the danger of uterine perforation. After evacuation of the uterine contents, the woman should be treated as a puerperal patient. Full doses of ergot should be given for some days after the removal of the mole.

2. Fibromyxomatous Degeneration of the Chorion, or Myxoma Fibrosum.—This disease is even more rare than the preceding. It is limited, as a rule, to the placental area, and occurs during the latter part of pregnancy. It has been described by Virchow and Hildebrandt, and is characterized by fibroid degeneration of the connective tissue of the chorion at the placental site. Small tumors are formed that eventually undergo myxomatous degeneration. After this change has taken place the parts concerned have a soft, gelatinous feel. The fetus may not be destroyed, on account of the tardy development of the disease. The symptomatology is not clear, and labor may take place before the diagnosis is made. The treatment can only be symptomatic.

3. Chronic Choriitis, or Inflammation of the Chorion.—The chorion shares the characteristics of other vascular tissues, in being subject to low grades of inflammation. From this cause dense adhesions are formed between the chorion and the amnion and the decidua. Syphilis may often account for this condition. Or, an endometritis may be the forerunner of inflammation of the decidua, in which the chorion takes part. Abortion will probably result. The treatment is symptomatic.

III. ANOMALIES OF THE AMNION AND LIQUOR AMNII.

1. Plastic Exudation, Amniotitis. 2. Abnormal Tenuity. 3. Cysts and Dermoids. 4. Premature Rupture, Amniotic Hydrorrhea. 5. Anomalies in Color and Composition of Liquor Amnii. 6. Oligohydramnios. 7. Hydramnios.

Introduction.—As might logically be expected, the similarity between the pathology of this fetal membrane and that of other serous structures is very striking. There is the same chance for the occurrence of changes of secretion, inflammations, exudations, serous and plastic, and bands of adhesions.

1. Plastic Exudation, Amniotitis or Amnitis.—This affection generally occurs in embryonal life, when the amnion lies against the developing skin of the child, and it is due to the scarcity of liquid, and its failure, consequently,

to lift the fetal membrane from the child's body. When this condition is extensive, two results may follow: First, the decidua becomes detached, and this is naturally followed by death of the fetus and severe hemorrhage from the maternal vessels. Second, a great many fetal malformations may occur, for

FIG. 241.—AN AMNIOTIC ADHESION EXTENDING FROM THE SCALP TO THE EDGE OF THE PLACENTA, AND TWISTED AROUND THE UMBILICAL CORD. THE FETUS HAS A DOUBLE HARE-LIP.—(*Winckel.*)

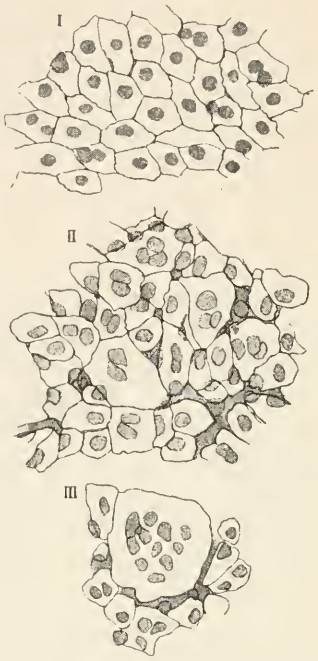


FIG. 242.—NORMAL AND PATHOLOGICAL AMNION EPITHELIA. I, Normal amnion epithelia; II, amnion epithelia in hydramnios; III, the same with giant cell. —(*Ahlfeld.*)

bands of plastic exudation are formed, which connect the fetus and amnion. As the amniotic cavity grows, these bands are stretched, and they may connect different parts of the fetus, or one or both ends may freely float in the surrounding liquid. There are no blood-vessels in these bands. At times they prevent the normal arching over of the body-cavities, and eventration, anencephalus, or some other anomaly of non-union results. Spontaneous or intrauterine amputations not infrequently follow amniotitis; the bands may wrap around a limb, and so constrict its blood-supply that its further development is impossible; and there is either perfect separation, or the part, hindered in its growth,

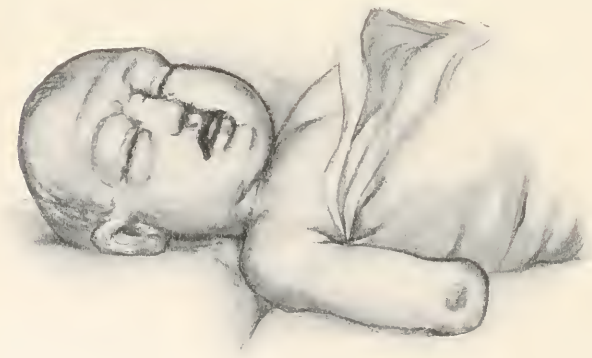


FIG. 243.—AMPUTATION OF ARM BY AMNIOTIC ADHESIONS.

atrophies. If the limb is completely amputated, and this has happened before the third month of pregnancy, there will probably be entire absorption of the member before birth. If later than this period, the amputated part may be extruded in labor after the birth of the child. The idea that the umbilical cord produces amputations is erroneous, for the cord itself would be so compressed in such a case that its circulation would be interfered with, and the child would die of asphyxia.

2. Abnormal Tenuity.—In the latter part of gestation, on account of abnormal tenuity or thinness, the amnion may rupture and become separated from the chorion. The latter remains intact, while the amnion is rolled on itself, forming cords or bands, which may wind around the fetus, or become so entangled with the umbilical cord as, by constriction, to cut off its blood-supply, thus causing the death of the fetus.

FIG. 244.—DEFORMITIES OF THE FACE AND SKULL CAUSED BY AMNIOTIC ADHESIONS. —(*Lepage.*)

3. Cysts, Dermoids.—The formation of cysts in the substance of the amnion has been described; they are

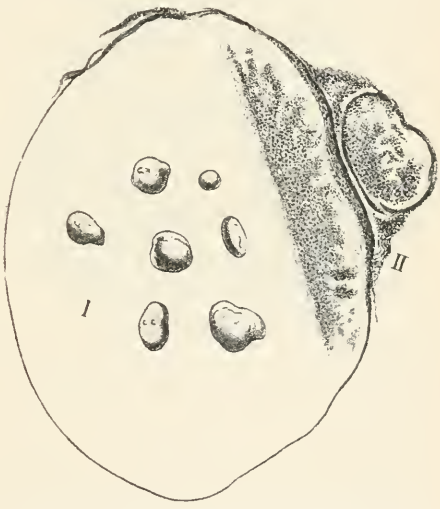


FIG. 245.—DERMOIDS OF THE AMNION. I, Multiple dermoids (½); II, one of the dermoids with daughter-cyst.—(*Ahlfeld.*)

small and of no clinical importance. Dermoids have also been described. One has been observed that was attached by a pedicle to the amnion of an aborted fetus. Besides cysts, caruncles and tuft-like growths have been noted in connection with the amnion. In the case of fetal death, certain changes take place in the amnion, which result in the loss of its glistening appearance, and in a considerable thickening of its substance. The histology of this condition is not understood (Fig. 245).

4. Amniotic Hydrorrhea.—Rupture of the amnion may be followed by abortion. Occasionally, however, the amnion and chorion are ruptured at a point

remote from the internal os, and the amniotic liquid drips away for weeks before labor. This is called amniotic hydrorrhea (Fig. 247).

5. Anomalies in Color and Composition of the Liquor Amnii.—The color, which in the latter part of gestation is normally an opaque white, may become reddish from the presence of a macerated fetus, or it may be green or brown, from the escape of fetal meconium. When the amount of liquid is extremely small, its consistency may resemble that of molasses or mucus. If the mother has diabetes mellitus, it may contain sugar. Sometimes the liquor amnii is decomposed. This is generally coincident with the death and putrefaction of the fetus, in which case a true *physometra* (gaseous products of putrefaction) is present to a certain degree. However, instances in which, with this condition, the fetus was born alive are on record. For such cases no explanation has yet been given.

6. Oligohydramnios consists of a deficiency of the amniotic liquid. This is a rather rare condition, occurring only once in three or four thousand cases. The great disadvantages of this affection are seen in the early part of pregnancy; for the uterine walls are not sufficiently separated, and consequently fetal deformities occur, such as talipes, bowing of the limbs, ulcers on the prominent parts of the body from the constant friction, adhesions between the amnion and fetal surfaces, and intrauterine amputations. In some cases abortion occurs, as the growth of the fetus is seriously interfered with. When this condition continues into advanced pregnancy, the uterus is strikingly small and hard. The movements of the fetus being limited, the mother becomes so conscious of them as actually to suffer discomfort or pain therefrom. Labor is generally difficult and abnormally prolonged. No treatment is available, even though the condition is diagnosticated before birth.

FIG. 246.—COMPRESSION OF THE FETUS IN OLIGOHYDRAMNIOS.—(*Ahlfeld.*)

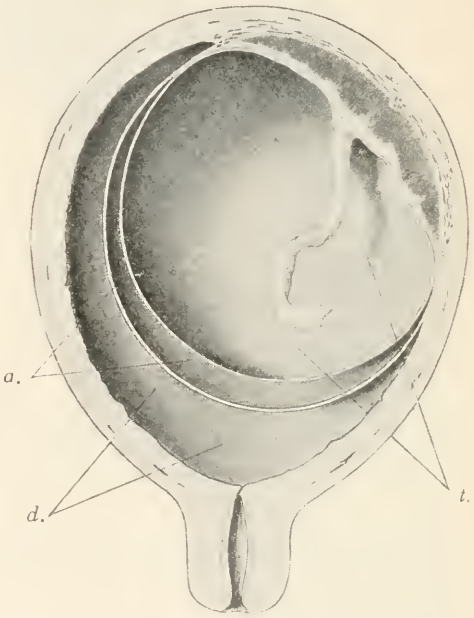


FIG. 247.—DIAGRAMMATIC REPRESENTATION OF THE DIFFERENT VARIETIES OF "FALSE" AMNIOTIC CAVITIES AND WATERS. *a*, Amnio-chorionic water; *d*, decidual water; *t*, true amniotic cavity and liquor amnii proper.—(*Bumm.*)

7. Hydramnios, Polyhydramnios, Hydrops Amnii, or Dropsy of the Amnion.—*Definition.*—This condition consists in the excessive accumulation of amniotic fluid in the amnion, or of a deficient absorption of the same.

Pathology.—It is difficult to estimate exactly the normal amount of liquor amnii, for in labor it dribbles away and is mixed with blood; but approximately it measures from one to two pints. If there is much more than this quantity, hydramnios exists. The condition is not pathological until about five pints accumulate. In general, the liquid collects gradually but persistently, giving a chronic form to the affection, till at term it may reach six gallons and more. There is a condition known as *acute hydramnios*, in which the increase is very rapid, and from the resulting distention of the uterus grave symptoms supervene. It may develop within a few days, or, as in a case reported by Sentex, in a single night. This affection usually occurs in early pregnancy, and at the fifth or sixth month the abdomen is as large as it would normally be at the ninth or tenth month, or even larger. Schneider observed thirty liters at six months. The character of the liquid is generally like that of the normal liquor amnii. Prochownik states that it contains more urea than is normally present, owing to excessive secretion of the fetal kidneys. This condition is frequently associated with monsters; hydrocephalus, hemicephalus, spina bifida, cleft palate, harelip, club-foot, or some other deformity is present in 10 per cent. of cases.

Frequency.—Hydramnios occurs once in 250 or 300 cases. It is more frequent in multigravidæ than in primigravidæ (23 to 5); more frequent in twin pregnancies of the same sex than in single pregnancies. There are some cases of twins in which one sac contains more liquid than normal, while the other contains less. This condition has been observed in extrauterine pregnancy.

Etiology.—Three general causes are accepted in the etiology of this affection: (1) Fetal, (2) maternal, (3) amniotic. In abnormal states, in which the liquor amnii comes in contact with the floor of the fourth ventricle, fetal diabetes mellitus is caused, and, in consequence, an excess of fetal urine in the amniotic fluid. Changes or obstructions in the umbilical vein, such as phlebitis and thrombosis, also torsion of the cord, will cause damming back of the blood, and resulting transudation of serum. A large fetal bladder, by pressure on the vein, will force the blood back into the placenta. Lesions of the liver, the heart, the blood-vessels, or the kidneys of the mother, by interfering with circulation, may cause this trouble. Albuminuria, diabetes, and syphilis have been claimed as sources of the affection, as well as leukemia and anemia. The amount and degree of transudation through the amnion has been proved by Sallinger to depend upon the strength of the blood-pressure in the umbilical vein, and upon the size of the cord. Tumors of the placenta, causing an increased blood-pressure, will cause transudation, as will also fetal tumors that obstruct the circulation. The fetal skin may be the source of hydramnios. An abnormal blood-supply, sent by a hypertrophied heart, may excite the skin to extra activity. Other cases of extensive nævi, thickened skin, and elephantiasis congenita cystica, have been reported in association with hydramnios. The amnion itself may be productive of hydramnios. The condition of acute inflammation, amniotitis, may be followed by extreme serous exudation. This etiological factor would explain cases of hydramnios which follow traumatism of the abdomen of a pregnant woman. Adhesions between amnion and fetus have been developed in such cases. Acute hydramnios has also been ascribed to this cause. McClintock reports that in about 75 per cent. of the cases he has studied the fetus has been of the female sex. Hydramnios is at times observed in association with serous effusions in other parts of the maternal organism. It would therefore be of value in this trouble to make a blood examination of the mother, in order to ascertain if the hydremia so commonly found in pregnancy is increased. Certain cases of dropsy of mother and child,

associated with this affection and syphilitic in origin, have been reported. As to the theory of deficient absorption of liquor amnii, those cases of hydramnios coincident with nephritis and serous effusions in the mother could be explained in this way. In this affection the fetus is often born dead and shriveled, and the placenta is enlarged and œdematous. Maternal mortality after labor is also high, probably dependent upon the debilitated state of the patients. The large majority of cases which admit of any explanation—for, according to Bar, 44 per cent. of all cases have no demonstrable cause—can be traced to a fetal origin.

Symptoms.—In the *acute form* the symptoms are sudden, often intense, pain; fever, from the acute inflammation of the amnion; a great and rapid abdominal distention; inability of the patient to lie down; irregularity of pulse and respiration; dyspnea; and lividity of the face. The symptoms may be slight or pronounced. In the *chronic form* the undue pressure of the uterus on the abdominal contents causes impeded respiration and palpitation of the heart from the upward displacement of the diaphragm. But in this form the accumulation of the liquid is gradual, and is consequently not followed by the severe symptoms of the acute form. The distention becomes noticeable about the third or fourth month. It gradually and slowly increases, causing little discomfort to the mother. The patient is often somewhat depressed, but suffers little disturbance in general health. Sometimes insomnia is present, caused by the sensation of weight in the pelvis, which does not amount to real pain. Neuralgia of the abdominal walls, pelvis, and lower extremities results from pressure on the pelvic and sacral plexuses; and œdema of the abdomen, genitalia, and limbs, from obstructed pelvic circulation. There are excretion of scanty and albuminous urine, from interference with the renal circulation; digestive disturbances, as a reflex result of great uterine distention, or from the direct pressure on the abdominal viscera, and at times ascites, caused by pressure upon the portal vein. As a rule, the symptoms of pregnancy are increased in severity. The abnormally rapid increase in size of the uterus is the most striking symptom of this condition. Relief is often afforded by the occurrence of premature labor, the first stage generally being tedious, from the overdistention of the uterus. From this same cause there is a greater tendency than normal to post-partum hemorrhage, just as in the case of twins.

Physical Signs.—On inspection, we find abnormal distention of the abdomen. Palpation shows an enormous uterus, with tense and rather elastic parietes, and vague fluctuation. The fetus may easily be moved from one point to another, or even inverted. Auscultation reveals either a total absence of fetal heart sounds, or a muffled tone. Vaginal examination will show the elevation of the os, with a partial obliteration of the cervical canal. The lower uterine segment is elastic and tense, and the presenting part of the fetus cannot readily be palpated.

Diagnosis.—As a rule, the diagnosis is not difficult. If there exists a larger uterus than normal, the diagnosis of hydramnios is justifiable. There is, too, the history of pregnancy to add its weight of evidence. However, difficulties not uncommonly arise when there is a large collection of fluid, and when the fetus is small, or dead, so that there is an absence of fetal heart sounds and movements. It often occurs that, even though the enlarged uterus will give a liquid wave as distinct as that felt in an ovarian cyst, still by dipping deeply on palpation, the solid body of the fetus can be detected. The fetus will be abnormally movable. Differential diagnosis between hydramnios and *ovarian cyst* may be made by observing the following point: the development of hydramnios is far more rapid. If there exist (1) the fetal heart sounds, (2) if

the fetal body can be mapped out, (3) if the hypertrophied round ligaments can be traced, ovarian cyst can be excluded. The normal position of the uterus, whether pregnant or not, is low down in the pelvis in ovarian dropsy, while in hydramnios it is drawn high up, and felt per vaginam with difficulty (Kidd). The facies of ovarian trouble is characteristic in advanced cases. Finally, emaciation occurs. A most valuable distinction is the presence of Braxton-Hicks's sign, which always exists in pregnancy,—the occasional rhythmic contractions of the uterus, especially when excited by manipulation. If it can be proved that the hardening of the uterine wall thus produced extends over the whole surface of the tumor, then it is positive that the whole mass is uterus. When from its great distention the uterus resembles a large ovarian cyst, the cervix will generally yield more than it normally does at the fifth or sixth month of pregnancy, so much so that the finger can be inserted within it till it reaches the membranes. Hydramnios may be confused with *pregnancy complicated with ascites*, though it may be distinguished, before it has proceeded too far, by mapping out the uterine parietes, and by the detection of resonance along the flanks, in the dorsal decubitus; or with a cystic tumor of the broad ligament, or with a normal twin pregnancy. This diagnosis may be difficult or even impossible, but usually in hydramnios the uterine enlargement is more tense or fluctuating. The fetal membranes may be palpated, and the lower uterine segment, felt by vaginal examination, is generally distended, and the presenting part not palpable. This condition has been mistaken for *distended bladder*, with retroversion of the uterus. When the uterus is extended to its extreme limit, and a certain diagnosis cannot be made, the advisability of an abdominal exploratory operation should suggest itself, since but slight danger attends such a procedure. Abdominal *ascites* pure and simple must also be distinguished by the superficial position of the fluid, the difficulty of mapping out the uterus, and the physical signs, which show that the fluid exists free in the peritoneal cavity, and by the presence of dropsical effusions in other parts of the body. The area of dulness is variable, depending upon change of position of the patient. There is decrease in the quantity of urine and it is whitish and turbid. Extreme and constant thirst is present. There is a great distention of the hypochondria. In an extreme degree of ascites there is marked protuberance of the umbilicus.

Prognosis.—Authorities differ as to the gravity of the prognosis. It certainly is not very good for the mother, though naturally it depends on the cause of the existing condition. McClintock, out of thirty-three patients with hydramnios, lost four by rupture of the uterus, two by exhaustion, and one by infection. Winckel lost one by pre-existing pneumonia, while another had an attack of paracolpitis and parametritis, although she recovered. The pregnancy has a decided tendency to terminate early, from the extreme uterine distention, from the death of the fetus, or from the untimely detachment of the placenta; thus subjecting the patient to the risks of premature labor. Postpartum hemorrhage is very apt to occur on account of the uterine inertia, caused by extreme distention, and consequent weak labor pains and protraction of labor. Involution is prolonged, or not fully completed. Death may be a sequela, due to exhaustion, particularly in the acute variety. Fetal prognosis is unquestionably bad. Fully 25 per cent. of the children die. This high degree of mortality follows from fetal malformations, dropsical troubles, prematurity, and the frequency of abnormal presentations. Charpentier collected 113 cases, in which 20 presented by the shoulder, 21 by the breech, and 2 by the face. Many fetuses are in a diseased condition, and after birth show a

variety of pathological conditions: viz., syphilis, hydrocephalus, or elephantiasis. The common occurrence of prolapsed cord also adds to the fetal mortality.

Treatment.—The treatment should generally be expectant. The *acute cases*, however, demand immediate evacuation of the contents of the uterus. The os should be dilated and the membranes then punctured. The method of aspiration of the fluid through the walls of the uterus should not be countenanced. The precipitate discharge of the fluid should be avoided; the hand or gauze may be used as a plug. Serious cardiac disturbances on the part of the mother, or extreme discomfort, should indicate premature delivery. Especially if there is danger of death of mother, labor should be immediately induced. It has been suggested that a minute aspirating needle be inserted through the os, and a part of the amniotic liquid thus removed, in order to relieve the distressing symptoms, but not to bring on labor. This should, of course, be delayed as long as is consistent with the safety of the mother, although the great possibility of a monstrosity, or at least of a poorly developed child, diminishes the danger of prematurely induced labor. In such cases, measures to prevent hemorrhage should be instituted. The malposition of the fetus should also be guarded against.

Chronic hydramnios should be treated by the application of an abdominal binder (Fig. 228) and enforced rest on the part of the mother, in order to give the fetus the best opportunity to survive. In mild cases, interference is not necessary; but if severe respiratory or cardiac symptoms, great exhaustion, etc., are present, the pregnancy should be terminated, as in the acute form. The liquor amnii should be allowed to escape slowly, in order to avoid syncope, prolapse of the cord, and hemorrhage from premature detachment of the placenta. The precautions against hemorrhage should be observed, and every endeavor made to secure firm uterine contractions. If the expulsion of the fetus is too slow, it must be assisted in some way; although too early application of the forceps should be avoided, for fear of the later hemorrhage. After delivery by whatever method, there should be careful observation of the uterus for some time, and besides giving ergot, we should stimulate its contractions by the firm grasping of the uterus and by hot injections.

IV. ANOMALIES AND DISEASES OF THE PLACENTA.

1. Anomalies.—(1) Size: (a) Atrophy, (b) Hypertrophy, (c) Placenta Membranacea; (2) Form; (3) Number; (4) Relation; (5) Insertion—Placenta Prævia. 2. Injuries.—Premature Detachment; Accidental Hemorrhage. 3. Stasis and Œdema. 4. Interstitial Hemorrhage—Apoplexy; Infarction; Thrombosis. 5. Placentitis.—(1) Acute Septic, (2) Gonorrheal, (3) Emanuel's Disease, (4) Specific, (5) Chronic Interstitial and (6) Albuminuric. 6 Infectious Granulomata, Tuberculous and Syphilitic. 7. Secondary Metamorphosis.—(1) Progressive Hyperplastic and Sclerotic, Adherent Placenta; (2) Regressive, Results of Fetal Death; White Infarcts; Cystic, Calcareous, Fatty, and Miscellaneous Degenerations. 8. Tumors.—Placentomata, Polypi.

General Remarks.—A perfectly satisfactory account of affections of the placenta cannot be written because of our ignorance of the histology and development of this organ. No distinction can be made between the fetal and maternal placenta from the standpoint of pathology, because affections appear in both simultaneously, or pass from one to the other.

Etiology.—Diseases of the placenta originate as follows: (1) From certain pathological conditions in the maternal organism, and especially endometritis which antedates conception. (2) From general diseases affecting the mother, as syphilis, tuberculosis, acute infectious diseases, nephritis, leukemia, exophthalmic goitre. In this class, too, lesion of the endometrium is the connecting-link between the maternal and placental diseases. The endometritis, however, does not necessarily antedate conception, but may develop during pregnancy, the fetal portion of the placenta being the first to suffer. (3) From primary disease of the fetus, especially disturbances of the circulation including the umbilical vessels.

When the fetus dies from whatever cause, certain alterations are regularly produced in the placenta, such as obliteration of the vessels and fibrous degeneration of the cells. The converse, of course, is true, so that disease of the fetal and maternal placenta may cause defective nourishment and development of the fetus as well as the death of the latter, not only during pregnancy but in the course of an otherwise normal labor. This termination of pregnancy may occur repeatedly in the same woman. If the fetus with a diseased placenta survives, the increased resistance encountered by the placental circulation may have produced disease of the heart or of some of the other viscera. Again, the fetus may not die *in utero* as a result of the placental disease, but the pregnancy may terminate in missed labor, premature labor, or premature separation of the normally situated placenta. Placental disease is also responsible for some cases of hydramnios. We are unable to state whether placental affections can affect the health of the mother (nephritis of pregnancy, eclampsia, etc.). They play a very prominent rôle, however, in connection with labor (accidental and unavoidable hemorrhage, adhesions, retention, etc.).

Diagnosis.—There are no known methods by which placental diseases, with the exception of placenta prævia and accidental hemorrhage, may be recognized *in utero*.

Treatment.—With the exception of syphilis of the placenta we know of no affection of the latter organ which can be affected by treatment.

1. Anomalies.—(1) Size.—(*a*) *Atrophy:* By this term is meant simple qualitative atrophy, and not the diminution in size which is secondary to inflammatory affections. There is a tolerably definite relationship between the fetal and placental weights under normal conditions which is expressed by 5.5 : 1. When an otherwise normal placenta is of smaller size than this ratio requires, a condition of arrested development is present. Nothing whatever is known of the causes of primary atrophy, which is seen alike in the ill-nourished and the robust. (*b*) *Hypertrophy:* Simple hypertrophy is the opposite to the condition just described, the placenta being increased in area and thickness although of normal quality. It should not be confounded with an œdematous or hyperplastic placenta. As this condition is encountered only with very large fetuses, and preserves the habitual ratio, it is hardly to be ranked among anomalies. (*c*) *Placenta Membranacea:* This rare anomaly represents a placenta which extends over the greater portion or even the whole of the chorionic surface (Figs. 256 and 269). The expanded structure is correspondingly thin and membranous in texture. In this anomaly there is an evident failure on the part of the decidua serotina to develop into the normal placenta, with persistence of the chorionic villi. Clinically this anomaly generally constitutes a prævia (Fig. 269), and also complicates the third stage of labor by retention or actual adhesion and resulting hemorrhage. Fortunately, it is very rarely encountered in practice.

(2) Anomalies of Form.—These are best considered collectively. The principal aberrations in the shape of the placenta are as follows: (1) *Lobate placenta*, in which the organ is divided into two or more lobes (Figs. 249, 250, 251, 254, and 255). (2) *Horseshoe placenta* (placenta reniformis) (Fig. 257). (3) *Fenestrated placenta*, characterized by one or more solutions of continuity in the substance of the organ through which the chorion is visible (Fig. 253). *Annular placenta*, which extends about the uterine cavity like a belt (Fig. 253). Von Franque explains these anomalies by the supposition of abnormal development which results from endometritis. Some of the chorionic villi failing to develop, the placenta exhibits corresponding defects through which fantastic forms are assumed. Clinically, all of the preceding placentæ may cause disturbance of the third stage of labor through partial detachment and retention. They are less to be feared in this respect, however, than the subsequent class.

(3) Anomalies of Number.—These represent apparently a higher degree of the process involved in the genesis of the preceding class. Generally speaking, they are included under the term supernumerary or accessory placentæ. If these subsidiary structures contribute to the nourishment of the fetus, they are termed *placentæ succenturiatæ;* otherwise they are known as *false placentæ* (pla-

FIG. 248.—IRREGULARLY FORMED PLACENTA.—(*Auvard.*)

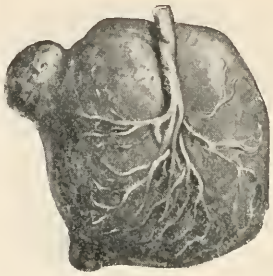


FIG. 249.—PLACENTA WITH SEVERAL IRREGULAR LOBES.—(*Auvard.*)

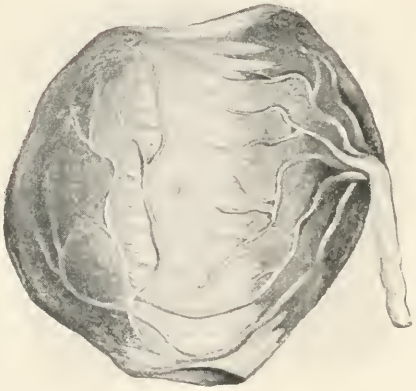


FIG. 250.—PLACENTA WITH TWO EQUAL LOBES.—(*Ribemont-Lepage.*)

FIG. 251.—PLACENTA WITH TWO UNEQUAL LOBES.—(*Auvard.*)

FIG. 252.—PLACENTA SUCCENTURIATA.—(*Ribemont-Lepage.*)

FIG. 253.—FENESTRATED TWIN PLACENTA AT SEVENTH MONTH.—(*Hyrtl.*)

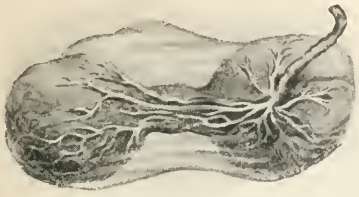


FIG. 254.—TRILOBED PLACENTA, TWO LOBES EQUAL IN SIZE.

FIG. 255.—PLACENTA WITH TWO UNEQUAL LOBES AND VELAMENTOUS CORD INSERTION. —(*Ribemont-Lepage.*)

FIG. 256.—PLACENTA MEMBRANACEA.—(*Ahlfeld.*)

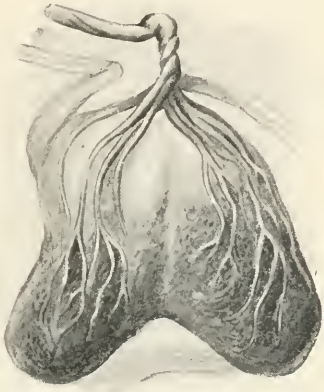


FIG. 257.—BILOBED PLACENTA "HORSESHOE" PLACENTA.

FIG. 258.—PLACENTA IN TRIPLETS. THREE DISTINCT MASSES OF PLACENTA, WITH AN ISOLATED COTYLEDON.—(*Ribemont.*)

FIG. 259.—SMALL ACCESSORY PLACENTA.—(*Ribemont-Lepage.*)

centæ spuriæ). As many as half a dozen of these accessory organs have been found in a single uterus.

These anomalies probably originate in one of two ways: (1) Endometritic

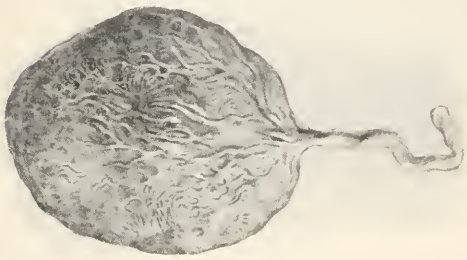


FIG. 260.—BATTLEDORE OVAL PLACENTA.—(*Auvard.*)

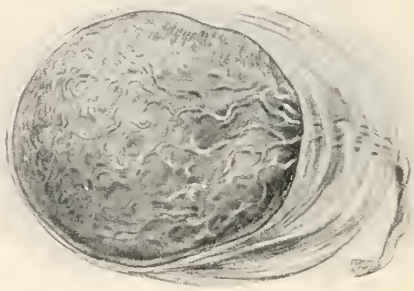


FIG. 261.—PLACENTA WITH VELAMENTOUS CORD ATTACHMENT.—(*Ribemont-Lepage.*)

proliferation during the development of the placenta may divide the latter into two or more segments, some of which may be small—mere single cotyledons, in fact. (2) An ovum may be implanted over a uterine angle, where a complete placenta would not form; as a result placental tissue develops on either side of the angle. This particular type is known as the duplex or bipartite placenta. Multiple placentæ as a class are said to occur in one labor out of about 352 (Ribemont-Dessaignes). The most common type of multiple placenta is the *placenta duplex*, or bilobed placenta, which was encountered by Ahlfeld 5 times in 3000 cases (Figs. 249 to 251). These anomalies may cause serious complications of the third stage of labor. The practitioner should always examine a placenta carefully to make sure that there is no apparent loss of substance.

FIG. 262.—PLACENTA SUCCENTURIATA.—(*Author's case.*)

(4) ANOMALIES OF RELATION.—By this term is meant the anomalous relations which may exist between the placenta and the other fetal appendages (membranes, cord). *Battledore Placenta:* This term is applied to a placenta in

which the cord has a lateral implantation (Fig. 260). It is considered under Anomalies of the Cord. *Placenta Marginata; Placenta Circumvallata:* When the chorion lævc begins within instead of at the border of the placenta the latter necessarily exhibits a free margin and is known as a placenta marginata. When the chorion forms a rigid annular fold at the inner limit of the margin, we have a so-called placenta circumvallata. These conditions have their inception before the placenta has arrived at its normal superficial growth. The outermost villi penetrate into the substance of the decidua vera, so that the latter is split, its upper segment becoming a part of the reflexa. Through some inflammatory process in the latter with resulting fibroid induration, the lateral expansion of the placenta is accomplished in an abortive fashion, the outer portion being without its normal chorionic investment. During the

Fig. 263.—Placenta Dimidiata.—(*Ahlfeld.*)

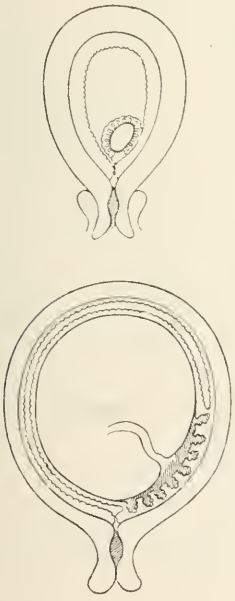


Fig. 264.—Diagram Representing the Formation of Marginal Placenta Prævia. The ovum becomes fixed to one side of the internal os : the chorion and placenta form, and a marginal placenta prævia results.—(*Ahlfeld.*)

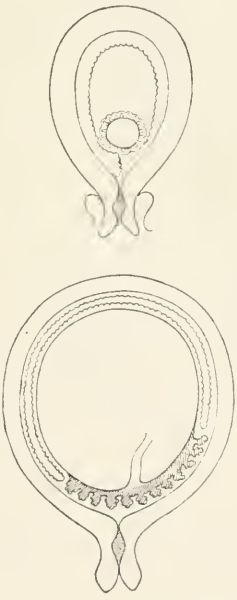


Fig. 265.—Diagram Representing the Formation of a Central Placenta Prævia. The ovum becomes fixed just over the internal os; the chorion and placenta form, and a central placenta prævia results.—(*Ahlfeld.*)

sclerotic contraction of the inflammatory zone in the reflexa, the chorion is forced into a sharp fold at its junction with the surface of the placenta (placenta circumvallata). As in the case of most of these placental anomalies, the

essential cause of the marginate and circumvallate forms is to be found in a diseased endometrium, which is responsible for the pathological condition of the reflexa. A higher degree of the process which causes the placenta marginata should, in theory at least, interfere with the growth of the placenta to such an extent as to cause the death of the fetus. The clinical significance of these placental anomalies is twofold: (1) The amnion and chorion are often intimately adherent, so that during expulsion of the after-birth the chorion may be torn from the placenta and left behind. (2) The complications pro-

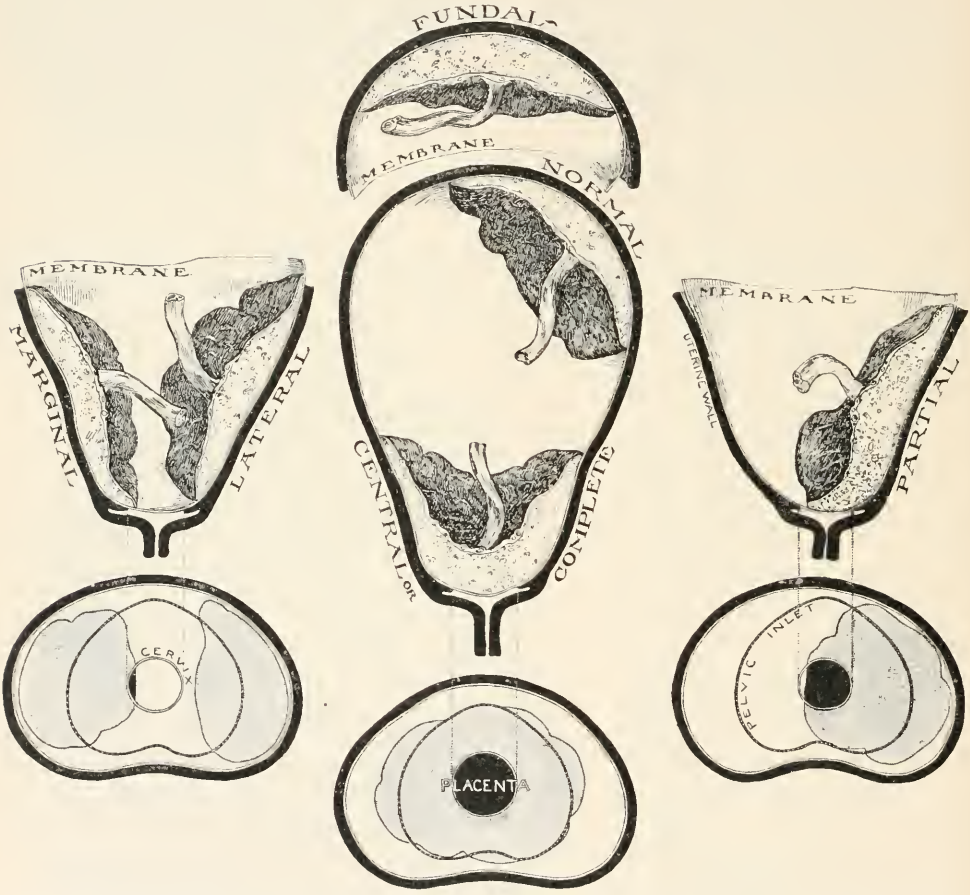


FIG. 266.—DIAGRAMS TO REPRESENT THE VARIETIES OF PLACENTA PRÆVIA ACCORDING TO THE DEFINITIONS SET FORTH IN THIS WORK.—(*Author's classification.*)

duced by other placental anomalies, such as incomplete detachment, retention, and atonic hemorrhages, are frequently encountered here.

(5) ANOMALIES OF INSERTION; PLACENTA PRÆVIA.—*Definition.*—The placenta is said to be prævia when it is attached to any portion of the lower uterine segment, and since dilatation of the segment is necessarily followed by hemorrhage from separation of the placenta, the condition is sometimes called unavoidable hemorrhage. Hemorrhages of pregnancy in the first months are usually due to abortion, menstruation, or lesions of the cervix, and are

not profuse. In the last three months they are almost always due to a premature detachment of a normally or abnormally inserted placenta. The former is considered under Accidental Hemorrhage. Placenta prævia has also been defined as a localization of the placenta over the internal os when the latter is dilated (Fig. 266).

Frequency.—In estimating the frequency of this anomaly as of others in obstetrics, account must be taken of the hospital service or private practice from which the conclusions are drawn. Thus, we find the proportion given as high as 1 in 250 and as low as 1 in 1000. In an indoor and outdoor hospital service, and in a private practice in which no emergencies and consultation cases are seen, the latter figure is not far from correct; while where emergency and consultation cases are counted, the proportion may easily approach the former figures. Statistics exhibit great irregularities. In some years the condition is so frequent as almost to simulate an epidemic. In 2200 pregnancies I found that the diagnosis of placenta prævia was made in 9 cases, or 0.40 per cent., or 1 in 244 cases. Three, or 33.33 per cent., were in primiparæ, and 6, or 66.66 per cent., were in multiparæ. One thousand of these patients were confined at the New York Maternity, where no emergency cases are received, and 1200 at the Mothers' and Babies' Hospital at a time when few cases outside the regular hospital service were cared for.

Varieties.—In *placenta prævia centralis* the placenta completely covers the lumen of the os after dilatation is complete. This form is very rare, and the placenta is placed to a great extent to one side of the uterus—especially the right side (Fig. 266). In *placenta prævia partialis* the placenta partially covers the lumen of the os after complete dilatation, and there is more placental substance on one side of the os than on the other (Fig. 266). In *placenta prævia lateralis or marginalis* the placenta does not reach beyond the margin of the internal os. This is the most common form (Fig. 266). In the lateral variety the placenta is situated on the lateral surface of the lower part of the uterus, not quite reaching the edge of the internal os. On dilatation of this lower uterine segment the placenta may be separated with very little loss of blood. In the marginal variety the placenta stretches down to, but not over, the internal os. These several varieties can be arranged again in two groups—complete and incomplete. The complete variety comprises the placenta prævia centralis, while the three varieties remaining are embraced under the term incomplete.

Etiology.—Placenta prævia is much more common in multigravidæ than in primigravidæ, the proportion being about six to one. Among the various causes which may result in faulty attachment of the ovum are conditions leading to enlargement and relaxation of the uterus and to changes of shape; *e. g.*, multiparity, multiple pregnancy, and uterine malformations; also conditions leading to changes in the uterine mucosa, as endometritis, abortions, and tumors. It seems more common in the poorer classes; owing probably to hard work and subinvolution of the uterus. Abnormally low position of the Fallopian tubes and abnormal size of the uterus are etiological factors. A diseased endometrium is probably the fundamental cause. It is believed by some that in a threatened abortion the ovum may be arrested in its descent and become attached near or at the cervix. Hofmeier and Kaltenbach propose another theory,—that the placenta is developed both in the decidua basalis and the decidua reflexa; adhesion occurs between the reflexa and vera, and therefore the placenta may be over the internal os.

Cause of the Hemorrhage.—It is necessary to understand thoroughly the

anatomy of the parts concerned in order to form a true idea of their mechanism, both normal and abnormal.

According to our present understanding of its morphology, the pregnant uterus consists of three parts which are distinct both anatomically and physiologically. The upper part or body is divided into two sections by Bandl's ring, while the cervix forms the third part (see Part IV). The physiological function of the cervix is active only during labor itself.

The normal arrest of the ovum is a little below the uterine opening of the tubes and above Bandl's ring. This statement is upheld by the fact that the placenta is nearly always attached to the side of the uterus. The fundal implantation is very rare. The area of attachment is very small in early pregnancy and the development of the placenta will conform to the growth of that part of the uterus to which it has attached itself. Above, the wall of the uterus becomes thicker and ready for its function—contraction; below, it becomes thinner and expands. In case the placenta is low down it will for a time conform to the uterine changes. First it will enlarge at the point of attachment, then it will expand to a certain degree; but when the limit is reached, then hemorrhage will occur. If the attachment is very extensive or particularly firm, there will occur partial rupture of the placental substance, or the placenta will separate from its base. During labor, as dilatation continues, the breech between the uterine wall and the placenta becomes gradually greater and greater: with each contraction of the uterus new placental tissue is lacerated. The retraction of the uterus from the placenta is most clearly seen in those cases in which only a small edge of placenta can be felt when the cervix begins to dilate, but in which nearly the whole placenta is lowered when dilatation is completed. But this changed position is not so much affected by the descent of the placenta as by the ascent of the lower part of the uterus.

The parturient uterus is characterized by three properties: contractility and retractility of the upper segment, dilatability of the lower segment. These explain the entire mechanism. This theory seems to be the most satisfactory of those advanced, and is founded upon the supposition that the lower segment of the uterus belongs to the body and not to the cervix. The idea is generally current that true decidua is never found on the mucous membrane of the cervix, so that the placenta cannot primarily be implanted there. This has not yet been positively proved.

The low implantation of the placenta undoubtedly renders it more liable to detachment from mechanical causes—such as shocks, jars, etc.—than when it is normally situated. In the upright position of the woman, moreover, the blood-pressure is greater in the placenta when it is prævia. The decidua reflexa may grow downward and become attached over the internal os.

Pathology.—The placenta is generally the subject of malformation; its form is irregular; it is thinner and covers a larger surface than the normally situated placenta; the decidual part is unevenly developed, being very thick above and thin below; the upper part is also very firmly attached to its bed, while the attachment of the lower part is very slender. The placenta may be bilobed or there may be a placenta succenturiata, causing errors in diagnosis. The forms which it may assume are varied. The adhesions between the placenta and the uterine wall are often abnormal, causing complications in its delivery. The insertion of the cord is also abnormal, and it is not often found centrally attached, but is apt to be nearer one side than the other. Prolapse of the cord is consequently not uncommon.

Symptoms.—The principal symptom is hemorrhage. It occurs without warning and varies from a few drops to an amount sufficient to produce grave anemia; the attacks, however, are usually slight at first and increase in severity; and the time of the hemorrhage often corresponds to a menstrual epoch. It occurs at any time of pregnancy, from the beginning of the third month to delivery; it is most frequent in the last month, though it may be looked for soon after the sixth month. The more nearly central the placenta, the earlier will be the occurrence of hemorrhage. Most cases of so-called menstruation in pregnancy are due to the low implantation of the placenta. There is usually no show of blood in the marginal variety till the beginning of labor.

During pregnancy the amount of blood lost is not so apt to be dangerous, but at the completion of gestation or during the commencement of labor the loss of blood may be tremendous, the constitutional symptoms of hemorrhage supervening, and within a few minutes the patient's life may be placed in great danger, death occurring within a few moments of the beginning of the hemorrhage. The hemorrhage ceases when (1) the separation of the placenta is completed; also generally after (2) the rupture of the membranes, for then (3) the presenting part of the placenta itself is forced down upon the bleeding uterine sinuses, closing their openings.

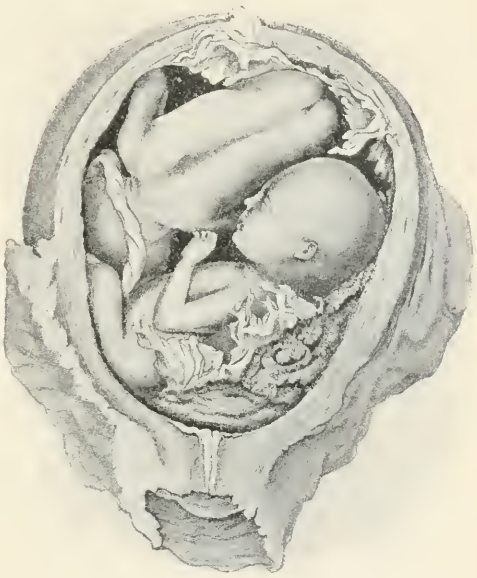


Fig. 267.—Placenta Prævia in Twin Pregnancy.—(*Hofmeier.*)

When labor has commenced, each contraction of the uterus causes fresh portions of the placenta to become detached, and consequently fresh vessels are torn and left open. The tendency of these contractions, however, in all forms of hemorrhage is to constrict the open mouths of the uterine sinuses and so to control the hemorrhages. The apparent increase of the bleeding in placenta prævia during a "pain" is due to the contractions of the uterus forcing out from the organ blood which had already escaped during the interval. In one way, up to a certain point, contractions do favor hemorrhage by detaching fresh portions of the placental tissue, but the actual loss of blood comes from the uterine sinuses during the interval and not during the contraction.

Course of Labor.—The first stage is liable to be delayed, since the presence of the placenta interferes with the cervical dilatation; unless the patient is exhausted by hemorrhage, however, the labor may progress rapidly after the presenting part has entered the cervix, since the latter is usually soft and elastic. Rigidity of the cervix is sometimes present (12 per cent. of the cases, Müller).

Diagnosis.—Early in pregnancy the diagnosis is impossible unless the placenta is actually palpated, but in the last third of gestation, the character of the hemorrhage and, after dilatation has been secured, the palpation of the

placenta, determine the diagnosis. Inspection and auscultation have no part in the diagnosis of placenta prævia. Little or nothing is to be gained by abdominal palpation, but vaginal exploration is most valuable. The only positive evidence of the condition is obtained by palpating the placenta with the fingers passed through the os. During labor this is best performed in the intervals between the pains, and, fortunately, in the last months of the pregnancy the cervical canal is usually yielding and patulous and offers little resistance to the finger in the class of patients most often suffering from this anomaly—namely, multigravidæ. Before dilatation of the os, by palpating the lower uterine segment through one of the vaginal fornices, the placenta may be made out through the uterine wall between the fingers and the presenting fetal part. Ballottement will be obscure or absent altogether, and the large placental vessels and those of the lower segment may be distinctly felt pulsating under the finger. The cervix and vaginal fornices are softer than normal and have a boggy feel, due to the increased blood-supply, and the presenting part is with difficulty made out through the placental substance. These signs are often more marked on one side of the cervix than the other. After dilatation of the cervix, if the placenta is centrally attached, the whole internal os will be covered over by a thick, boggy mass, soft and granular, distinguished from coagulum by its consistency and its resistance to pressure of the finger (Fig. 266). Through this placental mass the presenting fetal part may be felt, but far less distinctly than in the normal condition. If the placental attachment is only partial, the bag of waters will be felt, and above it the head, occupying one part of the internal os, while the rest of the aperture will be covered by the placental mass (Fig. 266). If the attachment is marginal, only the thick edge of the placenta will be made out near the rim of the internal os (Fig. 266).

Differential Diagnosis.—The condition is to be distinguished from accidental hemorrhage and from rupture of the uterus. (See Accidental Hemorrhage.)

Prognosis.—Death of the mother is due to hemorrhage and sepsis. The nearer to the time of labor the hemorrhage occurs, the better the prognosis, as dilatation and emptying of the uterus can more readily be accomplished. For the same reason the prognosis is better in multigravidæ than in primigravidæ, and during labor than in pregnancy. Again, the danger is greater for both mother and fetus the more centrally the placenta is placed, for when centrally located a greater number of uterine vessels will be exposed before labor can terminate. There is danger also of hemorrhage after birth, as the lower segment, flabby and inert from the muscular atrophy which follows the distention caused by the abnormal placenta, does not completely occlude the vessels left gaping after detachment of the latter. The cervix and lower segment should be very carefully guarded, as mechanical manipulations—especially in rapid dilatations and extractions—may fatally tear these parts. (See Part V.) Death may supervene suddenly after the bleeding has entirely ceased, from the great constitutional depression which follows the loss of blood.

The increased risk of septic infection is due (1) partly to the greater tendency which the vessels have for absorption as a consequence of their emptiness following the hemorrhage; (2) partly to the low position of the placental site, it thus being more exposed to external influences; and (3) lastly to the manual or instrumental interference at the placental site that may have been found necessary during delivery.

The less the bleeding is accompanied by uterine contractions, the graver is the prognosis, since labor pains always tend to close the mouths of the blood-vessels. Lastly, the greater the anemia that is brought about before actual labor, the greater the risk; since some operation may be demanded to hasten delivery which the woman in her weakened condition is little able to bear. There is more hope of saving the child than many authors admit, and this fact should be kept constantly in mind. In early gestation the cause of fetal death is placental apoplexy followed by painless abortion. In these cases the ovum is usually expelled entire (Fig. 268). Later on, after the child has become viable, the chief danger is asphyxia from the loss of maternal blood as a consequence of separation of the placenta. Other causes of fetal mortality are (1) malposition, the placenta in the lower uterine segment not allowing the head to present, the shape of the uterus also being distorted; (2) premature delivery found necessary to save the mother's life, and (3) version, which in many cases is performed to control hemorrhage or to effect speedy delivery. Hemorrhage and inanition may also be causes of fetal death. Malpresentation frequently occurs owing to the relaxed condition of the uterus and the softening and stretching of the lower uterine segment, and to the fact that the placenta usually occupies the space filled by the presenting part. Müller found in 1148 cases 272 transverse presentations and 107 breech presentations. Premature labor and premature rupture of the membranes are common in this condition. In our 9 cases of placenta prævia already cited, there was one maternal death, due to rupture of the uterus from rapid manual dilatation of the cervix. The maternal mortality was 11.11 per cent.; the fetal mortality, 22.23 per cent. Of the 9 cases, 4 were treated by manual dilatation of the cervix followed by immediate version and extraction; 2 by podalic version; 1 by manual dilatation and forceps, and 1 by spontaneous delivery.

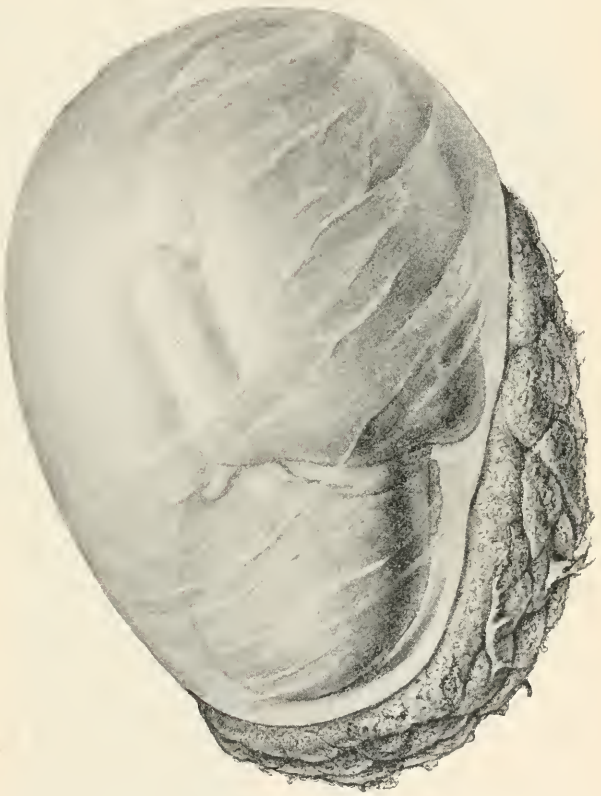


FIG. 268.—PARTIAL PLACENTA PRÆVIA AT FOUR AND A HALF MONTHS. Spontaneous expulsion of an unruptured ovum with moderate hemorrhage.—(*Author's collection.*)

Summary of Prognosis: The causes of the great *maternal mortality* are (1) hemorrhage; (2) septicemia; (3) inflammations—metritis, peritonitis, phlebitis; (4) shock of version, which operation is generally indicated, and is, in

many cases, performed when the woman is in an exhausted state from the loss of blood or previous attempts at delivery through an imperfectly dilated os. The causes of *fetal mortality* are (1) asphyxia; (2) prematurity; (3) version; (4) malpresentations; (5) inspiration pneumonia.

Treatment.—There is no preventive treatment of this condition. When the diagnosis of placenta prævia is assured, the broad rule is to empty the uterus at once. This is at least the theoretical aspect of the question. In practice, how-

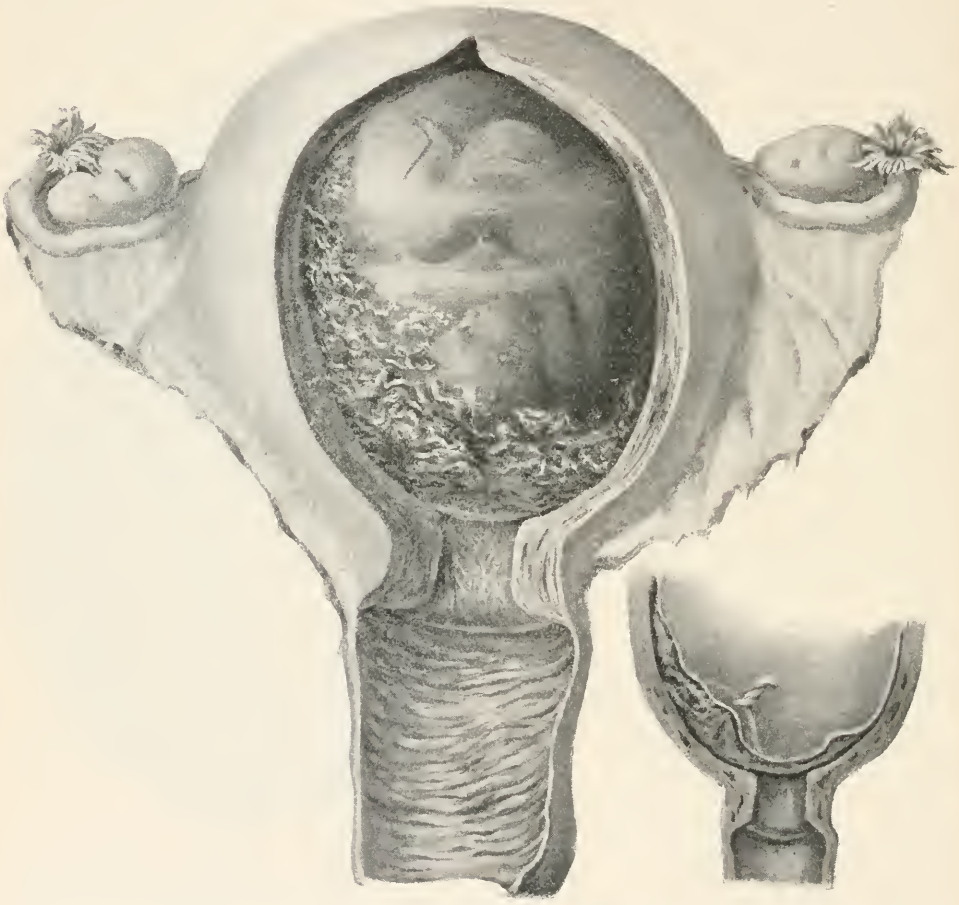


FIG. 269.—CENTRAL PLACENTA PRÆVIA AT THE SIXTEENTH WEEK. Sudden and spontaneous hemorrhage and death within six hours from acute anemia. Blood loss estimated at several pints. Placenta membranacea is also present. The membranes are unruptured. (½ natural size.)—(*Author's collection.*)

ever, numerous conditions assert themselves which constitute exceptions. A certain number, probably constantly decreasing, of practitioners regard intervention before the seventh month as meddlesome. Statistics show that fatal hemorrhage before this period is rare. Fig. 269 is a specimen in my collection from a woman pregnant at the sixteenth week, with placenta prævia, who died of uterine hemorrhage and acute anemia within six hours after the appearance of the first bleeding. The blood loss was estimated at several pints. The

minority, who dissent from the routine practice of emptying the uterus at all times, hold that the interruption of pregnancy before viability is unnecessary, unless for special indication, such as profuse hemorrhage. They claim also that if the mother is in no danger, the fetus should be given a chance of survival. The majority, on the other hand, maintain that the mother is always liable to a fatal hemorrhage; that moderate loss of blood up to the time of viability produces a weakening effect on the mother; and, finally, that the chances of the fetus for survival are so slight that they should be disregarded. To the dissent of a portion of the profession must be added the scruples of the prospective mother and her relatives. The idea of terminating the pregnancy without regard to the right of the fetus may be repugnant, and an heir may be greatly desired for more reasons than one. The mother, too, may be willing to accept the risk. In such a case the most the practitioner can do is to explain the dangers as fully as possible, and perhaps to call a consultation; the joint opinion of two practitioners should go far toward persuading the woman to choose the wise course.

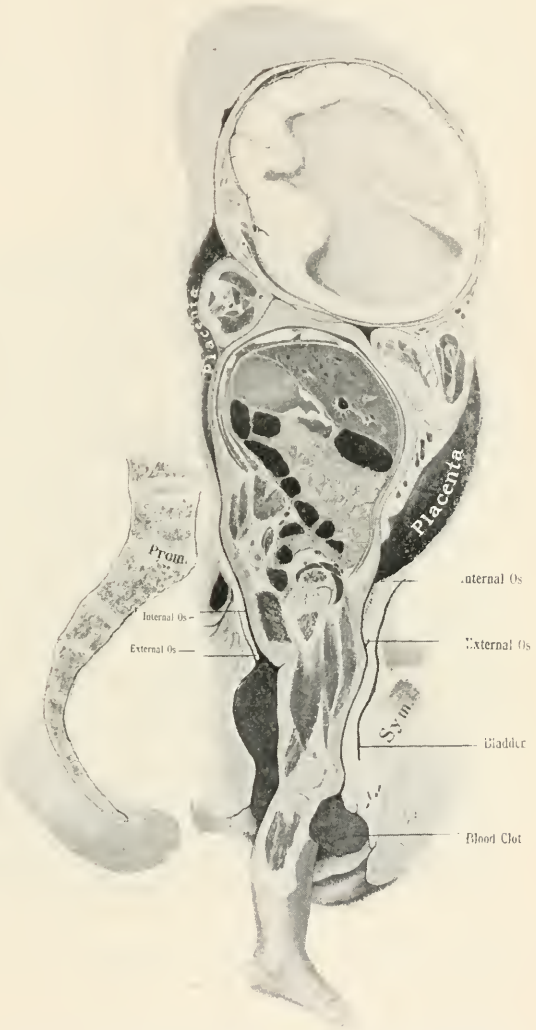


FIG. 270.—FROZEN SECTION OF A CASE OF CENTRAL PLACENTA PRÆVIA IN WHICH ONE LEG HAS BEEN BROUGHT DOWN ACCORDING TO BRAXTON-HICKS'S METHOD AND THE HALF-BREECH USED AS A TAMPON TO PLUG THE LOWER UTERINE SEGMENT AND THE CERVICAL CANAL.—(*Leopold.*)

If the condition is recognized before the seventh month, and the aim is to continue the pregnancy, the woman must be made to lead a quiet life, mentally and physically. She should, as far as possible, avoid all muscular effort, such as straining at stool. Coitus should be interdicted. The diet should be light. If moderate hemorrhage is present, she should lie in bed till all bleeding ceases. For uterine contractions opiates should be given. If the symptoms are more severe, the patient should be placed upon the full regimen for threatened abortion. The foot of the bed should be raised and cold applications made to the pelvis. The expectant method requires the constant presence of an attendant who is able to deal with a profuse hemorrhage should such occur. Only in the most

exceptional circumstances should expectancy in placenta prævia be considered either in pregnancy or labor. To be sure, I have observed several spontaneous safe confinements in placenta prævia of the lateral or marginal variety, and been able to demonstrate the condition to hospital staffs, and spontaneous delivery in premature cases may exceptionally occur, without dangerous blood loss in the central variety, by the placenta being born before or with the fetus (Fig. 268). However, because of the danger of an unexpected, profuse, and possibly fatal hemorrhage, in either pregnancy or labor, always present in placenta prævia, the uterus should be emptied as soon as possible after the diagnosis of the condition is positively made.

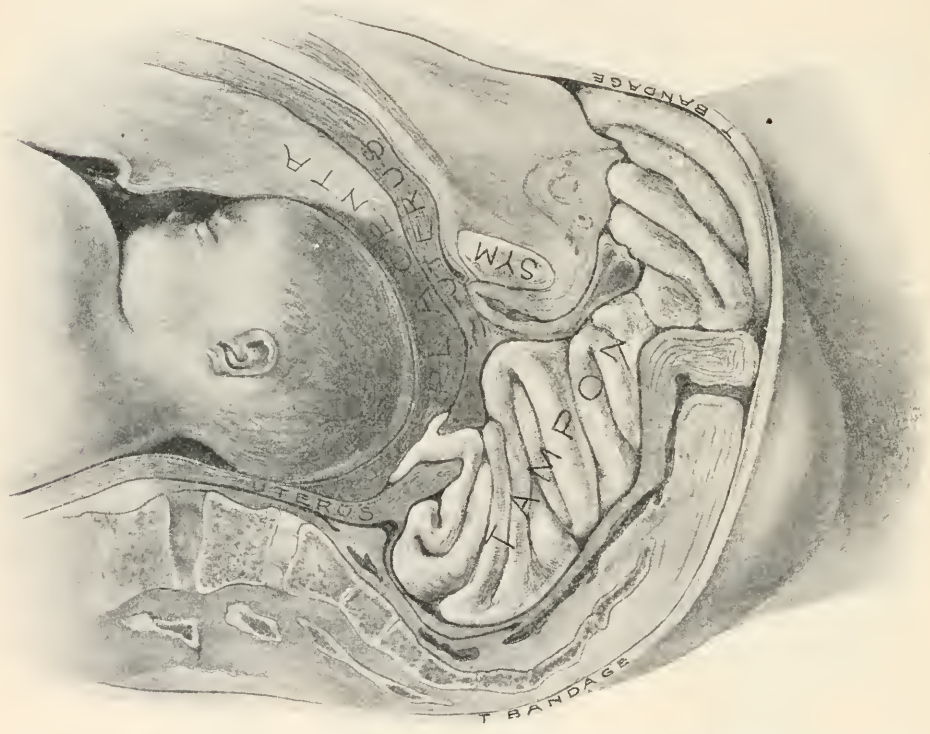


FIG. 271.—VAGINAL AND CERVICAL TAMPON IN CENTRAL PLACENTA PRÆVIA. Four-inch sterile gauze used for the tampon and a T-bandage applied.

In either pregnancy or labor there are three indications that must be met: (1) The first stage of labor must be rendered as short as possible by artificial dilatation of the cervix. (2) Hemostasis must be as complete as possible. (3) The second stage should be abbreviated.

In pregnancy labor should first be induced, and as soon as the cervix has been effaced, the indications for management, as just stated, carried out. In the absence of hemorrhage, and in lateral placenta prævia, labor can be brought on by the introduction of one of the smaller modifications of the Champetier de Ribes bags. For the introduction of the bag sufficient dilatation can be secured by dilating the cervix with one finger or with the Goodell type of instrument. In the presence of hemorrhage and in primigravidous women with rigid cervices

it is better to tampon the cervical canal and vagina tightly with sterile gauze. This procedure temporarily checks the bleeding, and rarely fails to cause a drawing up of the vaginal cervix, if not to induce active labor (Fig. 271). At all events, sufficient softening and dilatation are produced to permit a further rapid dilatation and delivery, or other manœuvre determined upon.

1. *Rapid Dilatation.*—In pregnancy or labor the cervix being in a readily dilatable condition, the best results for mother and child will be obtained by rendering the first stage as short as possible, thus minimizing the amount of blood loss. This is accomplished by instrumental dilatation with a dilator of the Bossi type or by manual dilatation. For the latter, I firmly believe the bimanual method is far superior to the one-handed method, because by it the fingers cause no unnecessary separation of the placenta, which the fingers of one hand passed into the os are bound to accomplish in complete placenta prævia. Dilators of the Bossi type are particularly well adapted to cases of rigid cervix, fortunately rarely encountered in placenta prævia. The Champetier de Ribes bag or its modifications rarely have a place here in accelerating the first stage or in controlling hemorrhage, and never in central implantation of the placenta, as separation of the placenta and concealed hemorrhage will result from their use.

2. *Hemostasis.*—At any time after the os is sufficiently dilated to admit two fingers, we always have a sure method of controlling hemorrhage in the Braxton-Hicks manœuvre of combined version. (See Operations.) (Fig. 270.) If in the midst of an instrumental or manual cervical dilatation bleeding becomes too free, one leg of the fetus should be brought down by the Hicks method, and the breech of the fetus used as a tampon to control further bleeding. It is my custom after the leg is brought out of the vagina, to attach a sling to it, and have an assistant make traction on the latter. I then proceed to complete the cervical dilatation by the bimanual method (Part X) and empty the uterus. It is under such circumstances, namely, when the thigh of the fetus plugs the cervix, that the bimanual method of dilatation is the only one feasible (Part X). Should the bleeding become alarming after almost complete cervical dilatation, it is usually best to perform the ordinary direct podalic version, and proceed with the breech extraction forthwith. Rupture of the membranes as a means to control hemorrhage is uncertain, and should be deferred until late in the first stage. My experience does not lead me to recommend its use.

3. *Shortening of the Second Stage.*—I believe the best results for both mother and child are secured by rendering the second stage as short as is consistent with the integrity of the mother's soft parts. This should apply even to those cases in which bleeding has been controlled by Hicks's bipolar version method, because the danger of internal concealed hemorrhage is always present. One should therefore elect forceps, podalic version, or breech extraction, according to the indications for each present. After profuse hemorrhage a patient will, when first seen, often be found to be suffering from acute anemia or collapse, and possibly she is at the moment losing little or no blood. It is advisable, in such cases, to tightly tampon the lower uterine segment, cervix, and vagina with sterile gauze, and wait until reaction has been secured by infusion, stimulants, and nutrient enema before completing dilatation or delivery (Fig. 271). In the case of a dilated or dilatable os and a collapsed patient it is justifiable partially to detach the placenta from the zone of dangerous attachment, or even entirely to detach and deliver it, tightly to tampon the lower segment and vagina, and to rally the patient before proceeding to the delivery of the child.

Cæsarean Section.—Eclampsia and placenta prævia have occasionally been

looked upon as indications for Cæsarean section, by reason of the high maternal and fetal mortality in both these conditions. I admit that the operation, or its substitute, vaginal Cæsarean section, is occasionally indicated in eclampsia, for the reason that eclampsia is more common in primigravidæ than in multigravidæ, and hence the cervix is more often persistently rigid in eclampsia than in placenta prævia, but, I believe, it is safe to state that placenta prævia will rarely demand Cæsarean section.

Management of the Third Stage.—Manual removal of the placenta is necessary only when after delivery the hemorrhage still persists. Sometimes bleeding continues after the placenta is born, and even when the uterus is well contracted. In this variety of post-partum hemorrhage the management does not differ from that of the ordinary fórms. (See Post-partum Hemorrhage.) It should be remembered that the low situation of the placental site predisposes post partum to hemorrhage and sepsis. As a prophylaxis against the former, especially after much blood loss prior to and during labor, the application of the uterine and vaginal gauze tampon is of great service.

After-treatment.—All danger is not over after expulsion of the placenta. The patient may be threatened with fatal syncope and must be kept recumbent with head low. If the indications arise, she should be given alcoholic stimulants by the mouth, and ether or caffeine hypodermically, with saline infusion. Vomiting, which is common after placenta prævia, should be met with cracked ice, and, if necessary, nutrient enemata.

2. Injuries.—Premature Detachment of a Normally Situated Placenta. Accidental Hemorrhage.—*Definition.*—Accidental hemorrhage is generally understood to mean one which occurs from the separation of a normally situated placenta, in contradistinction to the unavoidable hemorrhage of placenta prævia. These terms may be considered misnomers, as not infrequently the etiology is almost the same. The separation may be partial or complete, the former variety being far more common. It is one of the gravest conditions met with in obstetrics. Clinically there are two classes, those in which contractions of the uterus are present, and those in which they are absent. Quite recently Holmes, of Chicago, has published a thesis * based upon the analysis of 200 cases from literature. He advocates the use of a new name for this condition: viz., *ablatio placentæ*. He claims that the latter occurs much more frequently than has been believed.

Frequency.—According to Holmes, the ratio of ablatio placentæ to normal labor must be re-stated. In clinics where some effort has been made to recognize and record the existence of this complication something like 1 : 200 appears to be the prevailing proportion.

Varieties.—There are two ways in which this hemorrhage may declare itself: it may be frank or open, or hidden or concealed (Fig. 272); the former being the more usual, while now and then the two forms are present in the same case. The point of separation of the placenta in the first instance is generally at its lower part and the blood then easily trickles down between the chorion and the deciduæ and finds its way out through the vulvar orifice. In the concealed variety the detachment may take place at the center of the placenta, its connection around the entire periphery being at first perfect. In this case there would be formed a large clot behind the placenta. Or the separation may take place at the top of the placenta, in which case, as well as in the last, the hemorrhage would be to a certain extent limited. Then, again, the membranes may have ruptured and the orifice of escape may be blocked by the

* "American Journal of Obstetrics," vol. xliv, 1900.

presenting part or by some of the appendages of the fetus or by a large blood-clot.

Among the *predisposing causes* are profound anemia, general ill health with great debility, persistent pelvic congestion from any cause, prolonged gestation, multiparity, and the loose attachment of the placenta which is normal in the last two months of gestation and depends upon the fatty changes going on as preparatory to labor. Thus, we rarely see accidental hemorrhage until the last few weeks or at the onset of labor, and seldom in primigravidæ. It is questionable whether this hemorrhage can ever occur with a healthy placenta and uterus; some diseased condition, as syphilis, uterine or peri-uterine inflammation, or nephritis, is necessary as a predisposing cause. The observations of many point to a close connection between nephritis and this hemorrhage, the apoplexies and degenerative changes of the decidua and placenta favoring the hemorrhage.*

The most important cause of this complication is disease of the deciduæ.

Among the *exciting causes* is traumatism of various kinds, direct and indirect, received either externally or from violent muscular efforts on the part of the patient. This cause cannot be denied, although it is ignored by some authorities. Underhill reports a case due to direct traumatism, and I observed a case in which a woman pregnant at the eighth month, while hanging clothes from the fire-escape of a tenement-house, leaned heavily with her abdomen against the iron railing. Faintness and profuse uterine hemorrhage occurred immediately, followed shortly by labor and the delivery of a dead fetus and several large blood-clots. The placenta was situated above the lower segment.

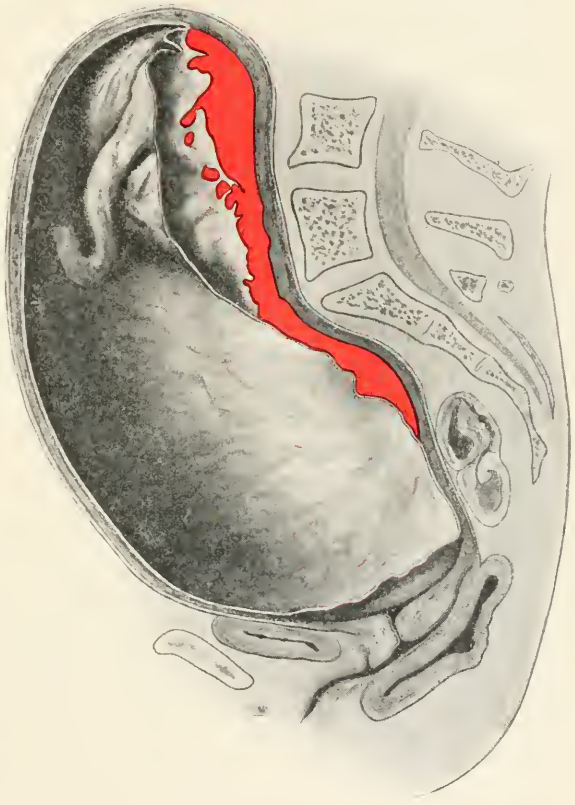


FIG. 272.—INTERNAL CONCEALED HEMORRHAGE FROM ENTIRE SEPARATION OF A NORMALLY SITUATED PLACENTA. INTERNAL CONCEALED "ACCIDENTAL" HEMORRHAGE.—(*Modified from Winter.*)

Hemorrhage from traumatism does not always follow the shock. In a case of mine it was delayed several days. This is in accordance with the observations of Kiwisch, who states that hours or days may elapse between the two events. Again, hemorrhage may occur when the patient is in repose or even when she is asleep. This accident has also followed indirect traumatism, as slipping on ice, lifting heavy weights, vomiting, coughing, concussion,

* O. Von Weis: "Archiv f. Gynäk.," Bd. XLVI, H. 2, 1893.

jolting, etc., by which probably some of the placental attachments were lacerated. Profound emotion has been given as an exciting cause by Barnes,* by causing sudden alteration in the equilibrium of the utero-placental circulation. A marked predisposition is undoubtedly present in these cases. A very short cord has sometimes proved to be the cause of this accident, especially if the fetus be vigorous. In hydramnios, in which the volume of the uterus is quickly diminished by the escape of a large bulk of liquid; or in twin deliveries, after the birth of one child, the subsequent contraction may cause placental detachment with fatal hemorrhage. Sligh's case† illustrates both of these conditions, as well as the necessity for instantaneous action in complications of this kind.

Certain cases have been reported in which the uterus was abnormal; in one case there was present vagina duplex, and the uterus also shared in the abnormality. Other cases have shown a condition of uterus bicornis with one horn rudimentary. If the placenta is attached to the latter, and should this horn contract while the rest of the uterus remains passive, the placenta may become prematurely separated. That this phenomenon does take place has been clearly proved.

Symptoms and Diagnosis.—In the *external form* the escape of blood is noticed, and at once points to the existing condition. The problem in the case of the concealed variety is often obscure. In certain cases marginal separation does not occur, and the escaping blood is collected between the uterus and placenta, where it forms clots which are retained in this situation (Fig. 279). More commonly, however, separation of the placental margin does occur, and there forms a collection of blood between the wall of the uterus and the membranes. This may be either in the region of the fundus or near the cervix. In the latter situation the blood may be prevented from escaping by the pressure of the presenting fetal part. In this case the coagula are prone to cause much pain from the distention and stretching of the uterine muscle. Besides the appearance of blood in the frank variety, there is generally *pain*, which is at times persistent and of a tearing, piercing character or cramp-like, colicky, and bearing-down. The suffering varies greatly in different cases. Pain may be localized at the placental region or at the lower uterine segment, due to stretching from retained clots. Instead of a sudden gush of blood, there may be a more or less continuous dripping, part escaping and part coagulating. This condition may continue for weeks.

The symptoms of the *concealed form* are chiefly extreme collapse and exhaustion with no apparent cause. In case of extreme internal hemorrhage with slight external escape, the diagnosis may be made by the fact that the constitutional symptoms are so much more severe than the amount of blood visible would be likely to account for. Shock may exist even when there is no great loss of blood; it is then due to enormous distention of the uterus. Besides the pain already referred to, which may be agonizing, there may be observed an irregularity in the form of the uterus, caused by the massed coagula. This is not easy to make out, except, perhaps, in the case of a patient who is thin and who has very lax abdominal walls. A rapid increase in the size of the uterus may be noticed. There may be a complete absence of labor pains, and if they are present they are usually slight and insufficient. Escape of blood-serum by the vagina is a symptom of great significance as indicating the persistence of clots within the uterus.

Differential Diagnosis.—Placenta prævia can be differentiated from acci-

* "System of Obstetrics," page 582. † "American Journal of Obstetrics," 1892.

dental hemorrhage only by actually palpating the placenta in the former, although the latter condition is apt to occur in the first stage of labor, to be attended by sharp pains, and to persist until the uterus is evacuated or the patient dies. No deviations from the conditions of normal pregnancy are revealed by vaginal examination in accidental hemorrhage. This statement must be slightly modified, as in the concealed variety vaginal examination may show a prominence of the vaginal part of the uterus. It is as if it were being pressed down into the vagina from above, while the presenting part is often well above the pelvic brim. *Rupture of the uterus* follows a protracted or obstructed labor or operation. There are previous thinning of the lower uterine segment shown above the pubis, recession of the presenting part, and diminution of the uterine tumor; the membranes have usually ruptured; escape of the fetus into the abdominal cavity may be observed, giving two abdominal tumors. It is easy to exclude lacerations of the cervix by palpation and inspection. A *ruptured extrauterine pregnancy* must also be taken into consideration. The history of the case should be investigated. Abnormal pains, changes in the fetal heart sounds, alterations in the outlines of the uterus, symptoms of the hemorrhage, and the condition of the vaginal part of the uterus afford the chief differential points.

Prognosis.—When there is an *external flow* of blood, the prognosis for the mother is not very unfavorable, since the condition may be readily recognized and treated. Speedy termination of pregnancy will check the bleeding and save the patient's life. The shock is not so great, for the uterus is not so distended; and the separation of the placenta is frequently incomplete. About 85 per cent. of the children are born dead. In the *concealed form*, however, there is far more danger, and here the mortality is great, for often the diagnosis is not made until the patient is nearly moribund. Of Goodell's 106 cases, 54 mothers died—51 per cent.

Other factors influencing this great mortality are the constitution of the patient, which is generally feeble and diseased, and the shock from overdistention. The very fact, too, of overdistention indicates loss of contractility of the uterine musculature. The nearer the completion of the second stage, and the more readily the cervix is dilated naturally or artificially, the better the outlook. In pregnancy the chances for fetus and mother are better in multiparæ than in primiparæ, on account of the ease with which the os can be dilated in the former.

For the child, the prognosis is even worse. Of 107 children, of Goodell's cases, 6 only were born alive—94 per cent. mortality. This is probably explained by the fact that when blood collects between the placenta and the uterus, the fetal part of the former is probably torn and the child dies from hemorrhage. Other causes of fetal death are prematurity and asphyxiation from interference with the function of the placenta. The maternal mortality in Holmes's series of cases is considerably lower than that commonly admitted—32.2 per cent.; his child mortality (85.8 per cent.) is slightly better than that heretofore taught. The death-rates (maternal) for concealed and open hemorrhages were 23 and 34.6 per cent. respectively. It is difficult to formulate special prognostic indications.

Treatment.—If the hemorrhage takes place during pregnancy and is not severe, the treatment should be parallel with that of threatened miscarriage. Or, even if the hemorrhage has been large but has entirely ceased, the uterus need not be interfered with. The treatment should then be preventive and

protective. These patients should always be carefully watched. It may be that a living child will be born at term.

In the presence of severe hemorrhage the two indications are (1) to secure tonic and continuous uterine contraction and (2) the emptying of the uterus as rapidly as is consistent with the safety of the mother. I believe the first indication is most surely obtained by (1) artificial rupture of the membranes, (2) massage and manual compression of the uterus, and (3) the repeated hypodermatic injections of ergot (ɱxxx of the tincture every fifteen minutes for three or four doses). The speedy delivery can be accomplished by rapid instrumental and digital dilatation of the cervix and the use of forceps, version, or perforation according to indication. Deep incisions of the cervix are occationally useful.

The most efficient check to hemorrhage is uterine contraction, which must be brought about if possible. By rupture of the membranes, the liquor amnii will escape and the uterine contraction will take place. If the loss of blood is very small, it may be that rupture of the membranes will be the only artificial step necessary, and the rest will be looked after by nature, though early rupture of the membranes delays labor. In severe cases the mother's safety alone should be considered, for the death of the child is reasonably certain.

In the milder forms, vaginal plugging, massaging the uterus, with general stimulation, should be used till the cervix is sufficiently dilated to allow of delivery. Tampons must not be used after rupture of the membranes, but the method of tightly tamponing the vagina when the membranes are intact, as practised at the Dublin Rotunda, has given good results. A modified Champetier de Ribes bag under the same conditions can be tried until dilatation is obtained. A firm abdominal binder should be applied to prevent any internal collection of blood from forming. Uterine compression and the administration of ergot will further contractions, as will the application of an ice-bag over the suspected place of hemorrhage. Cold may be applied by atomizing ether over the abdomen. If the hemorrhage does not cease, or if concealed hemorrhage is suspected, the uterus must be emptied. During the progress of labor and delivery the uterus should be carefully followed down by an assistant, and after delivery every effort should be made to secure and maintain uterine contraction. (See Expression of Fetus, Part X.)

Perforation may be indicated if the child is dead or non-viable, or if the fetal head is large or the maternal pelvis very small, or the hemorrhage so severe as to endanger the mother's life. Cæsarean section should be considered in extreme cases. If the patient is in collapse, it may be best to revive her by warmth and stimulants before operative proceedings are begun. The after-treatment consists in the prevention, if possible, of post-partum hemorrhage. When much blood has been lost, the resulting anemia must be promptly treated by hypodermoclysis of decinormal saline solution, with rectal and intravenous injection as well. There have been no recent advances made in the therapeutics of this affection, which is still unsatisfactory.

3. Stasis, Passive Congestion, and Œdema.—Obstruction of the return circulation of the placenta gives rise to a characteristic state of that organ. Through the resulting œdematous saturation, the size of the latter may undergo a fourfold increase. It becomes pale and friable, and hence easily disintegrated during expulsion, with retention of certain portions. As in the case of œdema elsewhere, stasis may not be the sole efficient cause, for a hydremic quality of the blood incidental to the underlying state of the patient may co-operate. Stasis and œdema of the placenta have been encountered in cardiac disease

(so-called cardiac placenta), renal disease, and other maternal conditions. More commonly, however, the causes are to be sought in hydramnios or some obstruction in the circulation of the fetus. The latter class includes syphilitic obstruction of the umbilical vein (Fig. 277), and disease of the fetal heart, liver, and kidneys. Finally, in general fetal anasarca the placenta may be œdematous. When the fetus is responsible for the œdema, the fetal portion of the placenta is chiefly involved.

4. Interstitial Hemorrhage (Apoplexy, Infarction, Hematoma, Thrombosis).—The effusion of blood is not necessarily interstitial, for it may be between the chorion and placenta, in the form of a large clot, over the whole external chorionic surface; or it may represent a utero-placental hemorrhage (Fig. 279). The first occurs during the first three months of pregnancy, before complete union of the chorion and decidua; after the third month, this union prevents effusion beyond the limits of the placenta. Hence during the greater portion of pregnancy the hemorrhage is apoplectic and sharply distinguishable from accidental and inevitable placental hemorrhages (Figs. 273, 274, 275, and 276).

Fig. 273.—Hemorrhages into the Placenta Caused by Albuminuria.—(*Ribemont-Lepage.*)

Pathology.—It is in the early months that hemorrhage more commonly occurs from true apoplexy, which consists in the rupture of the fragile maternal capillaries surrounding the villi. Later on in pregnancy, the cause is more often thrombosis in the sinuses, or rupture of the fine blood-vessels which enter the placental sinuses after penetrating the upper layer of the decidua serotina. These masses of coagulated blood, in their several stages of degeneration, constitute placental hematomata. These formations undergo the usual retrogressive metamorphoses. (1) The form of the fresh clot is most common when abortion has resulted from the hemorrhage. (2) The extravasated blood may be walled off by a fibrous envelope, more or less thick, and may consist of reddish or brownish liquid, or even clear serum, while the blood coloring-matter is collected upon the cyst-wall or the neighboring villi. (3) The liquid may contain numerous white blood-corpuscles, giving it the appearance of pus, and such collections have been described as "placental abscesses" by various writers. (4) In other cases the fibrin element may be in the ascendency. This condition is found particularly in certain cases of thrombosis of the placental sinuses; as in an aneurysm in the course of obliteration the slow coagulation of blood results in the deposition of layers of fibrin. (5) The serum may rapidly disappear, leaving the red blood-corpuscles in a mass, while the leucocytes are either distributed through the latter or collected in one place. (6) Still another change is the organization of the clot, by which a distinct neoplasm is formed, while the adjacent villi go through a fibro-fatty

degeneration. The utero-placental hemorrhage may be recognized, after the expulsion of the ovum, by the characteristic appearance of the latter. It is fleshy in consistency, dark bluish-black in color, and has a very smooth surface. On examination the amnion and chorion are found to be uninjured. The fetus may be absorbed, if sufficient time has elapsed between its death and the expulsion of the ovum. If the period of time is shorter, the fetus will be seen floating in the liquor amnii. If, as the ovum is discharged, the decidua becomes detached, the former looks much like a blood-clot. It is to the hemorrhage into the placental site, after the third or fourth month, that Cruveilhier has applied the term placental apoplexy. If the extravasation of blood takes place into the

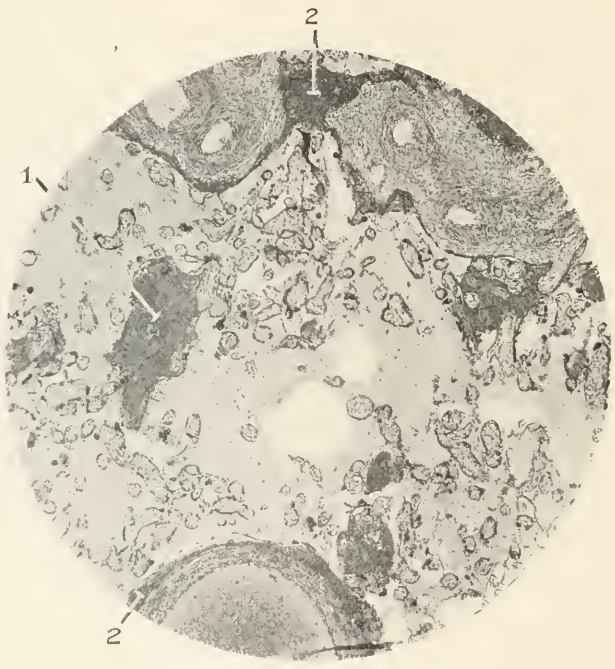


FIG. 274.—EARLY PLACENTAL INFARCT SHOWING COAGULATION NECROSIS OF VILLI AND PORTIONS OF BLOOD-VESSELS. THE DARK HOMOGENEOUS AREAS ARE NECROTIC. × 35.—(*From a specimen in the Pathological Laboratory of the Cornell University Medical College.*)

1. Group of villi completely necrotic, fibrinoid homogeneous, staining deeply with eosin; 2. large vessels, the peripheral portions of whose walls are fibrinoid and necrotic.

uterine sinuses, thrombosis of the placental sinuses is said to have taken place (Slavjansky).

Etiology.—The blood-current in the sinuses of the placenta moves very slowly in its course; this sluggishness, with the predominance of fibrin in the blood of pregnant women, causes a tendency to thrombosis. The placental villi may be diseased. The heart from some cause may be stimulated to sudden and excessive action, which produces apoplexy not only of the placenta, but also of the brain. Syncope also gives rise to a tendency to thrombosis. The more common locality of the rupture is in the maternal part of the placenta; its cause is some pathological condition of the mother which leads to great arterial tension and venous congestion; *e. g.*, chronic nephritis. In this state any additional strain on the

already overtaxed venous walls makes them rupture, with the consequent apoplexy or extravasation. Traumatism also may produce this condition; for example, a blow upon the abdomen. If the cause be of fetal origin, death may result from the arrested blood-supply.

Symptoms.—There are no clinical symptoms characteristic of this condition. The condition terminates in abortion. When the discharged ovum is examined, the cause will be apparent.

Prognosis.—The danger increases with the advance of pregnancy, and in the latter months it is considerable.

Treatment.—The treatment is that of abortion and premature labor.

5. Placentitis.—To-day it is admitted that inflammation of the placenta may occur, even if very infrequently. The best argument for the existence of placentitis as a disease is the great number of progressive and retrogressive lesions, encountered in the organ, which are known to follow inflammation in other portions of the body. The principal objection to the recognition

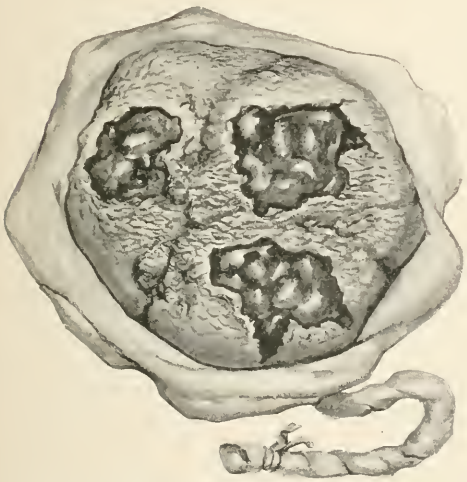


FIG. 275.—FRESH HEMORRHAGIC INFARCT OF THE PLACENTA.—(*Schilling.*)

FIG. 276.—PLACENTAL INFARCT IN ECLAMPSIA. SUBAMNIOTIC NECROTIC AREA.—(*Schaeffer.*)

of the existence of placental inflammation lies in the absence of capillaries and nerves in the maternal portion. Placentitis may be divided into *acute* and *chronic* forms. (1) *Acute septic placentitis:* This affection is mentioned by authors as having been caused by direct infection either from attempts at criminal abortion or from rupture of a pyosalpinx into the uterus. Pus forms *in situ*, and with the phenomena of general sepsis, abortion results. (2) *Gonorrheal placentitis:* According to Donat, the gonococcus is able to cause an acute purulent inflammation which extends from the decidua serotina into the fetal placenta and produces interruption of pregnancy. Von Franque is skeptical as to the existence of this type of disease. (3) *Emanuel's disease:* This author has described a necrotic and purulent inflammation of the placenta in the lesions of which he found certain non-specific micro-

organisms. The affection first involved the decidua and thence extended into the maternal placenta, causing abortion. In this connection it may be stated that placentæ which exhibit many of the phenomena that commonly follow acute inflammation elsewhere (white infarcts, necrotic foci, thrombosis, etc.) may well have been affected by some form of bacillary disease. (4) *Specific placentitis:* Authors speak by implication of placental alterations in the acute specific infectious diseases. We have been unable to obtain any satisfactory account of these lesions. (5) *Interstitial placentitis:* This condition, which doubtless corresponds to the decidual and diffuse placentitis of some authors, is an interstitial inflammation of the maternal portion of the placenta which begins in the vascular trabeculæ. Through the changes which accompany chronic inflammation in general, the villi are subjected to compression and arrest of blood-supply. Secondary degenerative changes then ensue in the parenchyma of the organ, which becomes diminished in size. Firm adhesions may form between the placenta and the wall of the uterus. Endometritis, either primary or secondary, is doubtless the cause of a majority of these affections. Hegar and Maier once described a form of interstitial placentitis which was essentially a periarteritis. (6) *Renal or albuminuric placentitis:* There are no constant changes in the placentæ of women who are suffering from albuminuria, but such individuals very commonly exhibit such alterations as white infarcts, round-cell infiltration, various degenerations, hemorrhages, fibrous hypertrophy of villi, endarteritis and periarteritis, etc. These lesions in turn cause defective development or death of the fetus, premature delivery, premature separation of a normally seated placenta, and, much more rarely, adhesions. All these changes may occur without nephritis, the latter being only a contributory cause, acting perhaps indirectly through the presence of endometritis of renal origin.

FIG. 277.—SYPHILITIC PLACENTAL VILLI. Marked proliferation of the connective-tissue and round-cell infiltration (5), especially in the neighborhood of the thickened blood-vessels (1); a few of the villi have lost their protoplasmic investment and are in process of conversion into intervillous thrombi (3); 6, normal protoplasm containing nuclei; 7, villous blood-vessels—healthy, belonging to the fetus—(original microscopic drawing).—(*Schaeffer.*)

6. Infectious Granulomata.—The placental changes in tuberculosis and syphilis are tolerably well known.

(1) *Tuberculosis.*—Localization of this affection in the placenta is extremely rare, and is known to occur only under the following conditions: In acute miliary tuberculosis, as well as in the chronicform of the same disease which follows pulmonary phthisis, we sometimes encounter small grayish-yellow tubercles in the organ. They are but sparsely present. The placenta is almost immune to attack from Koch's bacillus. The tubercles, which are usually caseous, are scattered in the intervillous space—decidua, villi, stroma, etc. The blood-vessels of the villi exhibit obliteration as a result of endothelial proliferation. In this manner the fetus might be protected to a certain extent from placental infection. The diagnosis of tuberculosis of the placenta has been verified by the demonstration of the bacillus and also by animal experiment.

(2) *Syphilis.*—This affection is perhaps the most prolific cause of death

of the fetus. The syphilitic placenta is larger, thicker, and lighter in color than normal. Its appearance suggests that it has been soaked in water. While the normal placenta is from one-sixth to one-eighth the weight of the child, the syphilitic placenta weighs about one-third or one-fourth as much as the child. The fact must of course be considered that the syphilitic child is less developed; syphilitic fetuses being generally smaller than normal. Macroscopically these placentæ may differ in appearance. If the fetus has been dead some time, the placenta will be very pale in color, soft or slippery, and greasy to the touch. If the child lives till term, the organ is commonly unusually large and pinkish in color, due to the hypertrophied decidua, which hides the true color. Normal villi possess only a few cells but many blood-vessels; the syphilitic villi are filled with round cells which have undergone fatty degeneration and resemble embryonic cells. In syphilitic villi the blood-vessels are scarce; the stroma is increased, and is represented by granulation tissue; the blood-vessels show endarteritis, and in hardened specimens the villi are seen to be thickened. Parts of healthy tissue of the placenta, which intervene between the diseased areas, may exhibit extravasations. However, these characteristics do not give absolute proof, but probability, of syphilis. Corroboration may be furnished from the condition of the child. When gummata are found, as in cases in which maternal syphilis antedates conception, they vary in size from a hempseed to an olive, and possess the characteristic structure of gummata in other situations. These formations have a central core of soft yellowish or reddish cheesy degeneration, surrounded by concentric lamellæ, or a true abscess cavity, with fatty walls which secrete pus. They often undergo fatty and calcareous changes. *Diagnosis:* It is impossible to make an accurate diagnosis during pregnancy. *Prognosis:* The fetus generally dies rapidly of malnutrition, owing to obliteration of the nourishing blood-vessels. Placental syphilis is one of the commonest causes of abortion. The greatest maternal risk occurs at the time of labor, from adherent placenta and subsequent sepsis. The *treatment* of fetal syphilis will generally be prophylactic. If both parents of the future embryo be affected with the disease, then antisyphilitic treatment should be instituted in both individuals. If only one be syphilitic, it would be useless to treat the healthy one.

7. Secondary Alterations in the Placenta.—Under the head of secondary progressive alterations we shall consider hyperplastic and sclerotic changes, together with adherent placenta. Degenerations comprise the results of fetal death, white infarction, cystic, fatty and calcareous degeneration, etc.

(1) *Hyperplastic and Sclerotic Changes.*—Proliferation of fixed connective-tissue cells with an immediate tendency to hyperplasia and an ultimate disposition toward sclerotic and atrophic metamorphosis is a sequel to a number of primary placental affections. These changes are due in most cases to chronic placentitis, whether the latter be owing to simple endometritis, renal disease, or syphilis. Fibrous metamorphosis has received various terms: viz., interstitial placentitis; sclerosis of the placenta; scirrhous, tuberculous, or cartilaginous degeneration, etc. Of special clinical interest are the adhesions which form as a result of the organization of hyperplastic tissue between the placenta and the uterine wall; and the white infarcts, so called, which are due in part to the constriction of certain areas of placental tissue by the same sclerotic process.

(2) *Adhesions.*—Adhesions between the placenta and the uterine wall are of rare occurrence, for the majority of cases thus characterized are only instances of simple retention. True adhesion, however, occurs at times, and the two

structures are then consolidated to such a degree that any natural separation is impossible. Adhesions may also be the result of imperfect development (absence of glandular zone, of entire serotina, etc.; see Part II), through which the villi become deeply imbedded in the muscular wall of the uterus. (See Part V.)

(3) *Degenerations which Follow Fetal Death.*—After death of the fetus *in utero* the circulation persists for a while in the intervillous space, the placental tissue remaining intact. The fetal vessels gradually become obliterated by endothelial proliferation. The stroma becomes changed into fibroid tissue. The fixed connective-tissue cells of the pedicles of the villi, chorion, and amnion begin to proliferate, with resulting thickening of these structures. Langhans's layer and the syncytium also show irregular proliferation. In the course of time the syncytium disappears, and the villi become transformed into a hyaline substance devoid of nuclei. The circulation in the intervillous space ceases as a result of thrombosis. Fatty degeneration, calcification, and other degenerative processes are in evidence. The placenta as a whole undergoes marked shriveling, becoming small, thin, and of a hardness suggesting leather or cartilage. Upon section it is white and almost homogeneous.

(4) *White Infarcts.*—White infarcts constitute grayish-red, yellowish, or pure white areas of the placenta which replace the spongy, highly vascular tissue of the latter. At first only moderately firm, they increase in hardness progressively from the deposition of lime-salts. In certain cases, however, there is a secondary softening of the infarcts, which may terminate in cyst formation. Microscopic infarcts occur in all placentæ and fully 50 per cent. of the latter exhibit infarcts which are visible to the naked eye; hence these small formations are physiological. But infarcts of considerable size, also, are frequently encountered. The large or pathological infarcts, some of which may involve half the placenta, have a various extent and distribution. They may be scattered here and there as rounded or stellate areas without any regular arrangement, and are then termed insular. Wedge-shaped infarcts have their bases in the serotina and their apices among the masses of villi. Annular infarcts are sometimes seen, and may involve the free border of the placenta or be seated within the periphery. Finally, there is a type of infarcts known from its location as the subchorial. The nature and pathology of white infarcts have given rise to much discussion. The simplest and most plausible explanation is as follows: In the hyperplastic and sclerotic changes which have just been described, beginning as an endarteritis in the chorionic villi, compression of placental tissue must necessarily occur at times in certain areas which ultimately have their blood-supply cut off and undergo the transformation known as coagulation-necrosis. This lifeless tissue becomes changed to a homogeneous mass of hyaline appearance, which undergoes various retrograde changes, such as softening, canalization (so-called canalized fibrin), cyst formation, calcification, etc. Secondary hemorrhages may occur about these infarcts. As these formations are deprived of blood-vessels, the area of the normal placental tissue is diminished to a greater or less extent, so that the nutrition of the fetus may suffer, even to the extent of abortion. The danger to the mother lies in the possibility of the formation of adhesions between the infarcts and the uterine wall, with resulting irregular detachment and retention of the placenta.

Williams* examined 500 consecutive placentæ for infarcts, including both white and red varieties. He found 185 of these specimens free from all appearance of such lesions except to an almost microscopic degree. But

* Prof. Welch's Festschrift, 1900.

15 were the seat of the red or hemorrhagic variety. The remaining 300 placentæ all contained white infarcts, distributed as follows: on the surface, 223, or 44.6 per cent.; purely marginal location, 77, or 15.4 per cent. As implied above, microscopic infarcts are invariably present. The mere act of infarct formation is physiological, and, at best, a normal senile degeneration of the placenta. When present in a high degree, it is the result of some disease, and more especially albuminuria, in the mother. We are quite unable to explain the pathogeny of morbid infarct formation, but it seems certain that bacteria play no part therein. The inherent independence of albuminuria and eclampsia is shown by the fact that we do not necessarily find high degrees of infarction in the latter disease.

(5) *Cystic Degeneration.*—The great majority of placental cysts result from softening. In some cases the latter process is primary and results from liquefaction of the original myxomatous tissue of the placenta. There is some analogy between these formations and vesicular moles. The largest and most familiar placental cysts, however, result from the softening of infarcts. These may attain such dimensions as to simulate a second bag of waters. This type of cyst is largely subchorional in location. The cystic fluid is usually cloudy and contains albumin. Placental cysts may rupture during labor (Fig. 278).

FIG. 278.—MULTIPLE CYSTS ON THE FETAL SURFACE OF THE PLACENTA.—(*Ribemont-Lepage.*)

(6) *Calcareous Degeneration.*—This is by no means uncommon; as a rule, it is not of clinical importance, and lime concretions are sometimes found in large numbers. Its occurrence in syphilis has already been mentioned. Placental calculi, ossiform concretions, placental ossification, stone placenta, have already been noted under the subject of infarcts. These deposits are almost always found on the uterine placental surface, in the decidua serotina, whence they may extend to the fetal part of the placenta. When the degeneration begins in the fetal structures, it is confined to them, and implicates the small blood-vessels of the villi, extending from their tiny extremities to their trunks. These concretions are in the form of grains, needles, or scales. They consist of amorphous carbonates and phosphates of lime and magnesia; as many as five hundred have been found in one placenta (Chambord). Stony scales or laminæ or even larger formations may be found in placentæ that have been left *in utero* weeks or months after the occurrence of fetal death. In the common form, during the life of the fetus, the placental function is not disturbed.

(7) *Fatty Degeneration.*—This frequently occurs, and modern investigation

tends to show that fatty change is usually consecutive to the fibrous metamorphosis (Robin-Ercolani). It sometimes occurs in the decidua serotina. Here, however, it is part of a chronic endometritis, the placenta being involved secondarily (interstitial endometritis of Hegar). A fibrous change may occur in the villi themselves, or in the interspaces; the usual contraction, obliteration of vessels, and fatty change following. This fatty tissue is friable and greasy to the touch. It greases any substance with which it comes in contact, and is rather firm in consistency.

(8) *Miscellaneous Degenerations.*—So-called *hyaline* degeneration is a phenomenon which accompanies white infarction. *Pigment deposits* consist of hemoglobin or its derivatives and result from extravasations of blood. They are usually small and disseminate, and are devoid of pathological significance. *Mucous* degeneration such as attacks the chorionic villi may occur at times in the placenta.

8. Placental Tumors.—(1) *Placentomata:* Excluding cysts, which are probably better regarded as an expression of degenerative change, and vesicular moles and deciduoma malignum which belong to the pathology of the deciduæ, a number of placental neoplasms—about fifty in

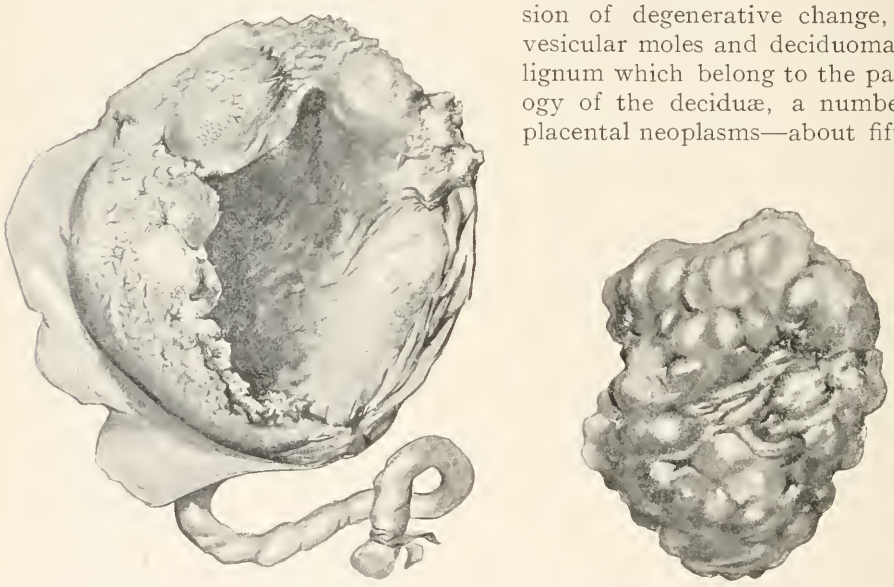


FIG. 279.—SEPARATION OF THE PLACENTA BY A RETRO-PLACENTAL HEMORRHAGE. The figure to the right is the blood-clot removed from the center of the placenta.—(*Tarnier.*)

round numbers—have been placed upon record, all of which appear to be of the same fundamental type. The favorite locality is the fetal surface of the placenta near the cord. Much more rarely they occur upon the maternal surface or in the substance of the organ. They are of a firmer texture than the placenta, from which their outlines and color are well defined, and are also isolated from the placental tissues proper by a well-marked capsule. Histologically these tumors are examples of *myxoma fibrosum*, although some authors prefer the name *angioma*, because of the great number of blood-vessels present. In a few cases of placental tumor the structure of sarcoma was approximated. None of the reported cases had any tendency to malignancy. Coagulation-necrosis often develops in these tumors. (2) *Placental Polypi:* These formations are not usually included under placental tumors proper, as they represent a disease

of the uterine cavity which was due originally to the persistence of placental residues. They may, however, be described in this connection. Placental polypi may be benign or malignant. The formation of the former has been described by Pilliet as follows: The fragments that are left behind after abortion may either assume new growth, by drawing their nourishment from the uterine vessels, or they may have deposited on them blood-clots, which become organized and constitute large polypoid tumors. These tumors give origin to abundant hemorrhages, muco-sanguinolent leucorrhea which is commonly very offensive, together with attacks of uterine colic. The uterus is boggy in consistency, large, and subinvoluted. Treatment should include thorough uterine curettage. The malignant or destructive placental polyp consists of a malignant growth of one villus or of several villi, which are apt to penetrate the uterine walls, even as far as the abdominal cavity. Death follows from exhaustion, hemorrhage, or peritonitis.

V. ANOMALIES OF THE UMBILICAL CORD.

1 Length. 2. Thickness. 3. Insertion. 4. Coils. 5. Knots. 6. Tangling. 7. Torsion. 8. Stenosis of the Vessels. 9. Cysts. 10. Calcareous Deposits. 11. Hernia. 12. Syphilis. 13. Obstruction of the Vessels. 14. Dilatation of the Umbilical Vein. 15. Hypertrophy of the Valves. 16. Congenital Tumors.

1. Length.—The cord at term is usually about twenty inches (50 cm.) in length; but great variations occur. It is sometimes almost absent, and cases have been recorded in which it was four or five feet (122 to 152 cm.) in length. There is one case recorded in which the cord attained the length of nine feet (2.75 m.); others in which it was only two-fifths of an inch (1 cm.) long. Deviations from the normal length are sometimes of clinical importance. (See Pathological Labor, Part V.) Abnormal shortness may come from natural or artificial causes; as, for instance, when adhesive inflammations of the amnion result in the gluing together of the coils of the cord, or when the latter become attached to the fetal skin or to the amnion. When it is extremely short, it prevents the descent of the fetus, or causes hemorrhage from premature placental separation, or even mal-presentation. When very long, it may form dangerous coils or knots (Fig. 280).

2. Thickness.—The cord may develop to the thickness of the adult thumb. In this case the vessels are normal, there being simply an increase in the density of the tissue of the cord (Figs. 288 to 290).

3. Insertion.—This may be central, lateral (battledore), or velamentous (Figs. 248 to 263). In the latter case the vessels of the cord pass between the membranes, for a greater or less distance, before reaching the placenta. This is due to the fact that during the development of the cord adhesions form between the cord and either the amnion or the chorion, thus interfering with the formation of the sheath, which normally binds them together. The eccentric position is by far the most frequent. Hyrtl's table includes many abnormal placentæ, and is, therefore, not absolutely correct. It is as follows: Eccentric, 54 per cent.; central, 16 per cent.; marginal, 19 per cent.; velamentous, 11 per cent. The last percentage is too great, as it is usually only 2 or 3 per cent. The velamentous cord is important from a practical standpoint, for rupture of the membranes may cause a rupture of the cord and the death of the fetus from hemorrhage. This form of insertion is a source

of considerable danger to the fetus, for the vessels, in their abnormal position, are exposed to traumatism, and their rupture may result in serious or even fatal hemorrhage, before the delivery of the fetus can be brought about. There is an analogous condition in that form called *meso-cord*, from its resemblance to the suspensory structures of the kidney, rectum, or colon. Here the cord, instead of having its normal insertion, is received into an amniotic fold which it first traverses. The well-being of the fetus is not at all interfered with by this anomaly.

4. **Coils.**—The cord frequently becomes wound around the fetus. I had a case in my own practice, in which the cord was coiled seven times around the child's neck, the result being the death of the fetus (Fig. 288). Another case is recorded, in which it was in nine coils about the neck. In 2200 labors I found the cord about the neck in 514 cases, or 23.36 per cent. The cord was coiled once about the neck in 19.77 per cent.; twice in 3.18 per cent.; three times in 0.40 per cent. Coiling was called by the earlier writers "*suicidium fœtus in utero*" (Figs. 283 to 287).

5. **Knots** (Figs. 288 to 290).—These form in consequence of the fetal movements; the fetus may pass through a loop in the cord, thus producing a knot;

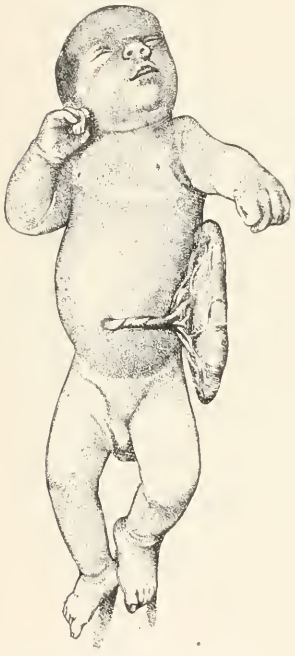


FIG. 280.—SHORT UMBILICAL CORD.

FIG. 281.—TANGLING OF THE UMBILICAL CORDS IN A CASE OF TWINS CONTAINED IN ONE AMNIOTIC CAVITY. *a*, Complicated knot of both umbilical cords; *A*, the same knot enlarged.—(*Ahlfeld.*)

these are of the most varied appearance. They are also due, at times, to uterine contractions during labor, before rupture of the membranes, and form a possible complication of version. Knots are usually harmless, since the constrictions are rarely tight enough completely to obliterate the lumen of the vessels. The pulsations of the cord favor the loosening of the knots, on account of the incessant repetition of the shock of pulsation. Rarely a true knot forms; false knots are the result of local increase of Wharton's jelly (Figs. 291 and 290). The obstruction of the umbilical vessels causes a more or less complete arrest of the circulation, which decidedly hinders the development of the fetus and may even cause its death.

6. **Tangling.**—In multiple pregnancies the cords sometimes become tan-

gled, and this accident results nearly always in asphyxiation of both fetuses, with their expulsion (Figs. 281 and 282).

7. Torsion.—This is a twisting of the cord on its long axis. It occurs most commonly about the seventh month. It was formerly supposed to be due to active movements on the part of the fetus, but it has recently been shown that, while a certain amount of torsion may be produced by fetal movements, it is never capable of occluding the vessels, and that the higher degrees of torsion occur after the death of the fetus (Schauta),

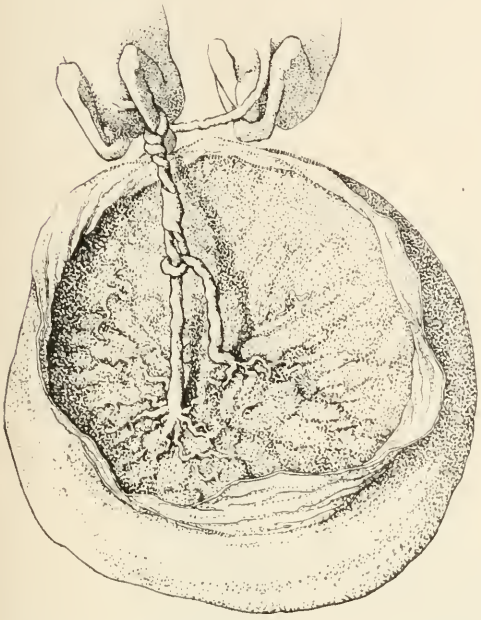


FIG. 282.—COILING OF BOTH UMBILICAL CORDS OF TWINS, ABOUT EACH OTHER AND ABOUT A LEG. ALSO TWO TRUE KNOTS.—(*Winckel.*)

FIG. 283.—COILING OF THE UMBILICAL CORD ABOUT THE FETUS AND ITS EXTREMITIES.—(*McGillicuddy.*)

FIG. 284.—COILING ABOUT A LEG.

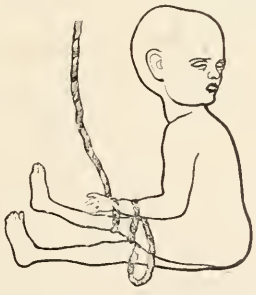


FIG. 285.—COILING ABOUT A LEG AND AN ARM.

FIG. 286.—COILING ABOUT THE NECK AND LEG.

FIG. 287.—COILING ABOUT A SHOULDER.

and as a result of the movements of the mother. Torsion occurs more frequently in the case of male children, in multiparæ, and with long cords. It usually occurs near the umbilicus, and the cord is frequently œdematous and the seat of thrombi

and cysts. A certain amount of twisting of the arteries around the vein is generally seen, commonly ten to twelve twists.

8. Stenosis of the Vessels.—The umbilical vein is sometimes narrowed by a local periphlebitis. This occurs at the placental insertion and usually does no harm. Thrombi sometimes form in the umbilical arteries, as the result of atheromatous changes, and partially occlude the vessels. If these processes are extensive, corresponding injury to the fetus of course results. This stenosis may be congenital. If the involvement concerns only the vein, hypertrophy follows, with congestion and œdema of the placenta. If, however, the arteries are also affected, the circulation of the fetus will be obstructed and the fetus will become œdematous.

9. Cysts.—Serous and mucous cysts are sometimes found in the cord. This may result from cystic degeneration which follows some obstruction to its circulation, and as a result a collection of serum formed in the spaces beneath the amniotic covering and in the tissues of the allantois. Possibly it is a result of the liquefaction of Wharton's jelly,

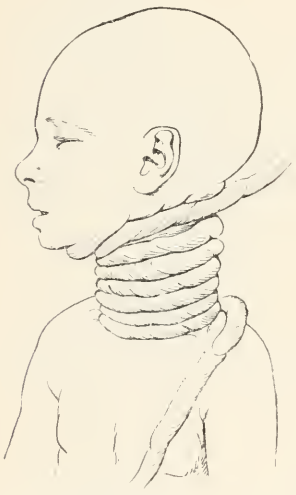


FIG. 288.—COILING OF THE UMBILICAL CORD SEVEN TIMES ABOUT THE NECK OF THE FETUS. DEATH OF THE FETUS AND MISCARRIAGE.—(*Author's case.*)

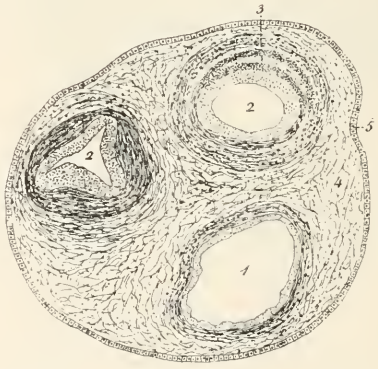


FIG. 289.—SYPHILIS OF THE UMBILICAL CORD. Transverse section showing inflammatory changes of the media and adventitia. 1, Vein with thin wall; 2, thickened artery; 3, round-cell infiltration; 4, stroma of normal myxomatous connective tissue; 5, external layer of cuboidal cells investing the umbilical cord.—(*Schaeffer.*)

the fluid collecting in the sacs that are formed; it may follow apoplexies of the cord. It is not clinically important.

10. Calcareous deposits are sometimes seen, and are supposed to be the result of syphilis. They are found in the mucous tissue or in the blood-vessels, but are of no importance.

11. Hernia.—This is the protrusion of some of the abdominal contents at the umbilicus, the result of faulty development. The intestines, in the fetus, are at first outside the abdominal cavity, and in case of hernia they have either failed to enter the abdomen, or, having entered, they are permitted to escape through a defect in the abdominal wall. In some cases nearly all the abdominal viscera escape. Sometimes the traction exerted by the escaped viscera produces deformities of other fetal parts, such as strictures of the rectum, or deformities of the legs. The dilated sheath of the cord envelops the protruded viscera. Often the infant is still-born. If the child is born alive, the displaced

organs must be protected by proper bandages till operation can be performed. This affection is really eventration rather than hernia.

12. Syphilitic Lesions.—Macroscopic lesions are induration of the cord, thickening of the vascular coats, disconnection of the funicular vessels, owing to the disappearance of mucous tissue. Histological lesions are endophlebitis and periphlebitis, endarteritis and periarteritis (Fig. 291).

13. Obstruction of the Vessels.—The disconnection of the funicular vessels, by the disappearance of mucous tissue (Wharton's jelly), is a very rare condition; it is known to have been due to syphilis, and is accompanied by vascular lesions, such as gumma of the external coat of the vein, endophlebitis and periphlebitis.

14. Dilatation of the Umbilical Vein.—The vein may be the seat of abnormal dilatations, of varicosities perhaps as large as a pigeon's egg, and injurious to the development of the fetus, on account of the embarrassment to the circulation. This condition, however, is generally unimportant, though sometimes one of the varicose veins will rupture. As a rule, this takes place close to the placenta, and a large hematoma is formed. At times the hemorrhage is so extensive as to cause fetal death.

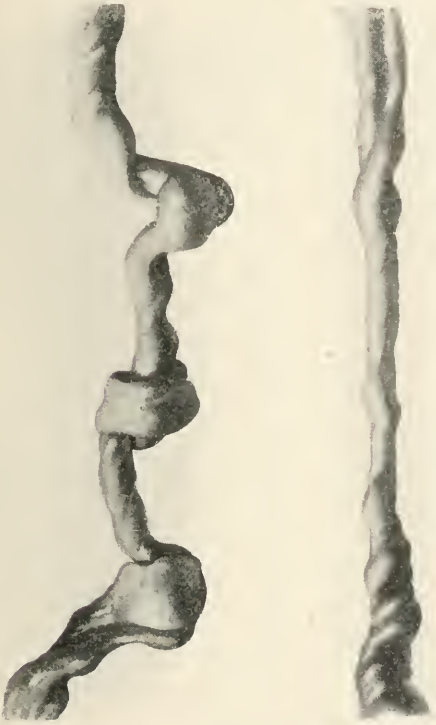


FIG. 290.—TRUE KNOT OF THE UMBILICAL CORD. The true knot is the center of the three in the left-hand figure, the ones above and below are false knots. The right-hand figure is the same cord with the knot untied.—(*Author's case.*)

FIG. 291.—FALSE KNOT OF THE UMBILICAL CORD.

15. Hypertrophy of the Valves.—This also rarely occurs. The etiology is probably syphilis; the lumen of the vessel is obstructed, and the situation of the valves may be indicated by large nodules.

16. Congenital Tumors.—Congenital tumors of the umbilicus are of very infrequent occurrence. They comprise atheromata and dermoids and so-called entero-teratomata. *Atheromata and dermoids:* In 1892 Pernice was able to

find reports of but three cases of these tumors in literature.* He describes these formations as benign epithelial tumors. Pernice believes that dermoids alone originate in the scar of the cord because the latter should contain no sebaceous glands. Atheromata doubtless originate in the skin around the umbilical scar. It is quite likely that the dermoid alone is congenital. *Entero-teratomata:* These growths, also known as adenomata, bear a marked resemblance to ordinary granulomata.

ANTENATAL PATHOLOGY.

Embryonal and Fetal Pathology in General.—Ballantyne and others make a sharp distinction between fetal and embryonal pathology. During the period of embryonal life, which is computed by various authors at from six to twelve weeks, what is known as organogenesis occurs. In other words, the future organs of the body are rapidly differentiated from the primordial embryonal tissue, so that at the termination of this cycle they have attained almost complete development. During the remainder of intrauterine existence there is little more than an increase in size, just as in extrauterine life. It seems most natural to suppose that disease in the embryo must be manifested rather by arrested or perverted development of organs than by ordinary pathological alterations. A slight malformation of an embryonal organ must increase in size with the growth of the latter; in no other way could the occurrence of extensive malformations be explained. But there is a close association between deformities and diseases; this causes the surmise that certain conditions which appear to be diseases of the fetal period have in reality an earlier or embryonal origin, and are themselves, therefore, malformations. On the other hand, a few true deformities may arise during the fetal period because organogenesis, while nearly completed in the earlier weeks of gestation, goes on, to a certain extent, throughout intrauterine life, and, indeed, through many years of individual existence. Those structures in which complete development is delayed include the bones, teeth, genitals, etc. The pathology of the embryonal period, then, is currently believed to be co-equal with the subject of teratology, or monstrosities, including malformations. We are still deeply ignorant as to the manner in which such conditions are produced. Studies of very early embryos which have perished either from intrinsic causes or from affections of the membranes throw hardly any light on the genesis of monstrosities. There can be little doubt that abnormal development of the amnion, with or without the formation of adhesions and constricting bands, would work havoc with the embryo, and probably the fetus as well, but the solution of the problem is hardly advanced by this theory. On account of the absence of facts in regard to teratogeny, I have omitted this subject, and after a statement of the little that is known of embryonal pathology, and illustrations of most of the (1) monstrosities, I shall consider (2) the diseases of the fetal period of intrauterine life, and (3) death of the fetus.

Pathology of the Early Human Embryo.—Professor Mall, of Johns Hopkins University,† has examined over fifty pathological embryos at very early stages of development. He states that after the second week pathological conditions are readily recognizable. Diseases of the very young ovum are of two kinds: primarily embryonal and primarily chorial. In the first group the

* "Die Nabelgeschwülste," Halle a. S. † Professor Welch's Festschrift, 1900.

embryo is affected while the development of the chorion is unchanged. In the second group the chorionic disease results in the strangulation of the embryo. Roughly speaking, these affections may be represented pathologically as consisting in three degrees: viz., (1) simple arrest of development, (2) partial destruction of embryo, (3) total destruction of the same. About twenty-three cases studied by Mall were examples of arrested development, while in five the embryo was partly, and in eight completely, destroyed. Eight cases were also noted in which the disease appeared to originate in the umbilical vesicle. It would appear that in the majority of cases the pathological process began in the embryo. The chorion is endowed with great vitality and is able to exist independently and undergo normal development for a considerable time after the death of the embryo, but finally its independent existence comes to a standstill, and it either persists as a cystic formation or collapses to form a fleshy mole. On the other hand, the embryo undergoes rapid destruction if the chorion becomes affected. In computing the period at which abortions occur we must naturally be guided by the degree of development of the chorion, not by that of the embryo. In simple arrest of development we may note the coincidence, for example, of a two weeks' embryo in a four weeks' ovum.

VI. DEFORMITIES AND MONSTROSITIES OF THE FETUS.

CLASSIFICATION.

- **(A) SINGLE MONSTERS** (Including Incidental Monsters or Anomalous Individuals).
  - **Anomalous Individuals.**
    - 1. Heterotaxy. Splanchnic Inversion.
    - 2. Hermaphrodism. { Complete. / Incomplete. }
    - 3. Hemiterata. Anomalies of:
      - (1) Growth. { (*a*) Excess. (*b*) Defect. }
      - (2) Non-union. { Subdivided according to locality. }
      - (3) Cleavage. { (*a*) Redundancy. / (*b*) Defect. }
      - (4) Structure. Microscopic.
      - (5) Persistence. { Non-disappearance of fetal structures }
      - (6) Conformation. { (*a*) Intrinsic. (*b*) Extrinsic. }

      Androgynoides. Gynandroides.
  - **Essential Monstrosities.**
    - 1. Teratomelus.
      - (1) Ectromelus. { (*a*) Hemimelus. / (*b*) Phocomelus, etc. }
      - (2) Symelus. { (*a*) Dipus. / (*b*) Monopus. / (*c*) Apus. }
    - 2. Teratocormus.
      - (1) Complete. Celocormus.
      - (2) Partial. { (*a*) Teratothorus. / (*b*) Teratosoma. }
    - 3. Teratocephalus.
      - (1) Involving spine. { (*a*) Iniencephalus. / (*b*) Exencephalus. / (*c*) Anencephalus. }
      - (2) Local. { (*a*) Hemicephalus. / (*b*) Encephalocele. }
    - 4. Teratoprosopus.
      - (1) Aprosopus.
      - (2) Paraprosopus. { Schistoprosopus. / Ectroprosopus. / Cyclopia. / Synotia. }
- **(B) DOUBLE MONSTERS.**
  - **I. Separate Twins.**
    - 1. Homologous Normal Twins.
    - 2. Omphalosites.
      - Paracephalus. { 1. Anceps. / 2. Dipus. / 3. Apus. / 4. Acormus. }
      - Acephalus. Thorus, Athorus, Acormus.
      - Amorphus. { Mylacephalus. / Anideus. }
  - **II. United Twins.**
    - Autosites.
      - 1. Dicephalus (epischistos).
        - (1) Sympygus. { Lecanopagus. / Ischiopagus. / Pygopagus. / Somatopagus. }
        - (2) Monopygus. { Monolecanus. / Monosomus (diprosopus). }
      - 2. Dipygus (hyposchistos).
        - (1) Syncephalus. { Craniopagus. / Hemipagus. / Janiceps. }
        - (2) Monocephalus. { (*a*) Dibrachius. / (*b*) Deradelphus. }
      - 3. Amphischistos.
        - (1) Thoracopagus. { (*a*) Sternopagus. / (*b*) Xiphopagus, etc. }
        - (2) Rachipagus.
    - Parasites.
      - 1. Heterotypus. { (*a*) Thoracopagus parasiticus. / (*b*) Dicephalus parasiticus. / (*c*) Acephalus. / (*d*) Athorus. / (*e*) Apygus. }
      - 2. Heteralius. { (*a*) Craniopagus parasiticus. / (*b*) Ischiopagus parasiticus. / (*c*) Dipygus parasiticus or polymelus (notomelus, pygomelus, etc.). }
      - 3. Endocyma. { (*a*) Polygnathus (epignathus, etc.). / (*b*) Sacrococcygeal tumors. / (*c*) Fetal inclusion. }
- **(C) TRIPLE MONSTERS** { **Tricephalus.** }

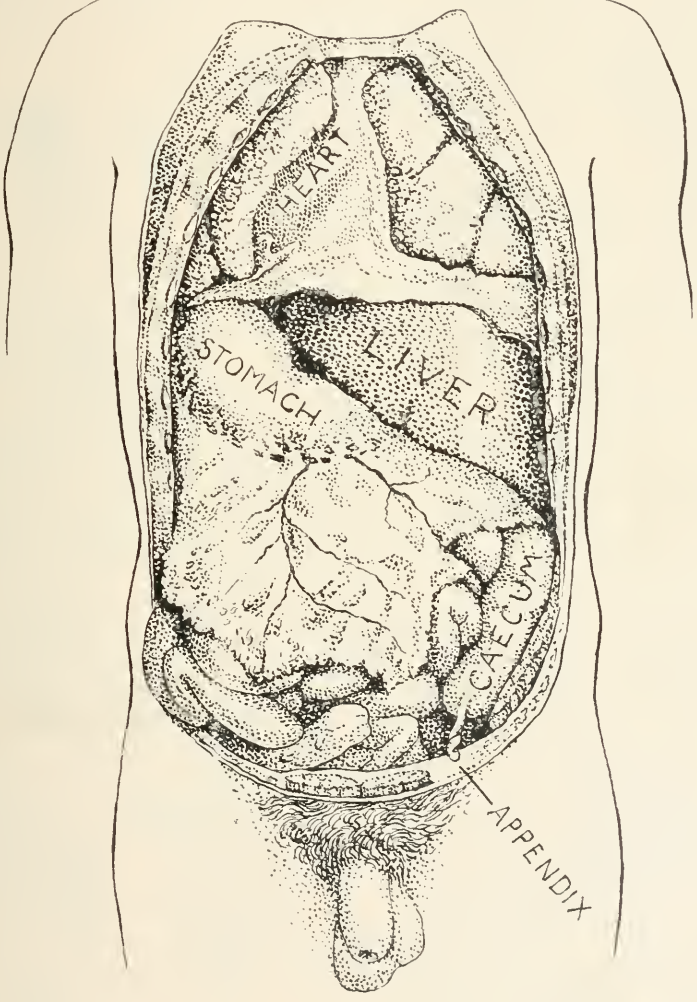
The illustrations of deformities and monstrosities are taken mostly from Ahlfeld's Atlas. A few are from Hirst and Piersol's Atlas and from photographs and drawings of the author's cases.

SOME OF THE MONSTROSITIES AND DEFORMITIES OF THE FETUS INCLUDING SIMPLE ANOMALIES

A. SINGLE MONSTERS

INCIDENTAL

I. HETEROTAXY



COMPLETE TRANSPOSITION OF VISCERA
FIG. 292

Minovici and Juvara: "Archives des Sciences Medicales," III, 1898.

2 HERMAPHRODISM

EXTERNAL

EXTERNAL MALE GENITALS SIMULATING FEMALE ORGANS
FIG. 293

FIG 294

EXTERNAL FEMALE GENITALS SIMULATING MALE ORGANS
FIG. 295

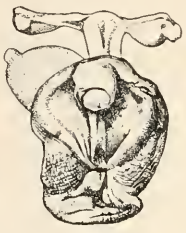
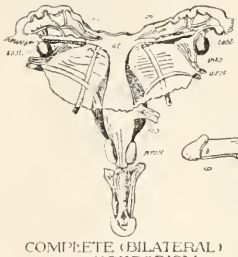


FIG. 296

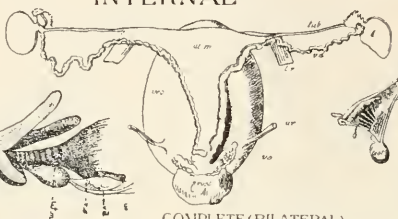
FIG 297

INTERNAL

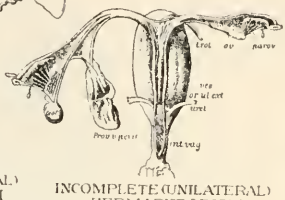


COMPLETE (BILATERAL)
HERMAPHRODISM
FIG 298

UTERUS MASCULINUS
FIG. 300



COMPLETE (BILATERAL)
HERMAPHRODISM
FIG. 299



INCOMPLETE (UNILATERAL)
HERMAPHRODISM
FIG 301

3. HEMITERATA

(1) ANOMALIES OF GROWTH

OVERGROWTH OF FINGERS
FIG. 302

OVERGROWTH OF ONE HALF OF TONGUE
FIG 308

DEFECT OF FIBULA
FIG. 309

OVERGROWTH OF HAND
FIG. 304

DEFECT OF RADIUS
FIG. 311

OVERGROWTH OF TOE
FIG 303

OVERGROWTH OF FEET
FIG 305

OVERGROWTH OF LEG
FIG 306

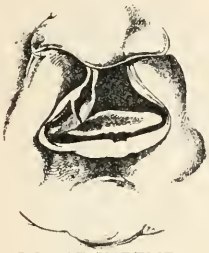
DEFECT OF FIBULA
FIG 310

DEFECT OF HIP JOINT
FIG. 313

DEFECT OF ULNA
FIG. 312

OVERGROWTH OF ONE HALF OF FACE
FIG. 307

(2) ANOMALIES OF NON UNION



DOUBLE HARELIP
FIG. 316

HARELIP AND CLEFT PALATE
FIG. 315

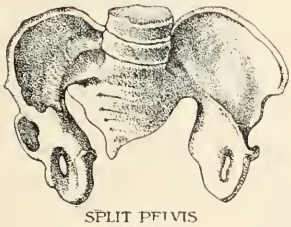
PERSISTENT
BRANCHIAL CLEFT
FIG. 319

TRACHEAL FISTULA
FIG. 318

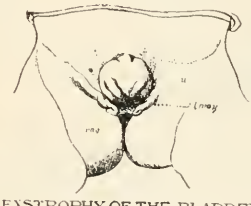
SINGLE HARELIP
FIG. 314

BUCCAL FISTULA
FIG. 317

CONGENITAL UMBILICAL HERNIA
FIG. 320



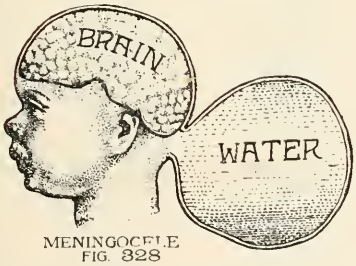
SPLIT PELVIS
FIG. 321



EXSTROPHY OF THE BLADDER
FIG. 322

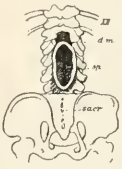
EPISPADIAS
FIG. 323

HYPOSPADIAS
FIG. 324

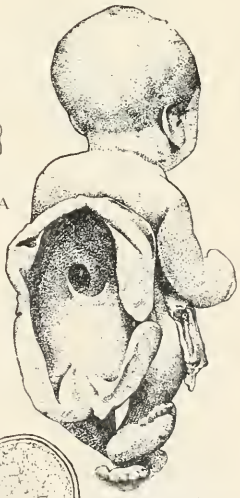


MENINGOCELE
FIG. 328

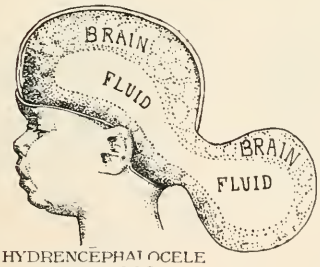
CERVICAL SPINA BIFIDA
FIG. 325



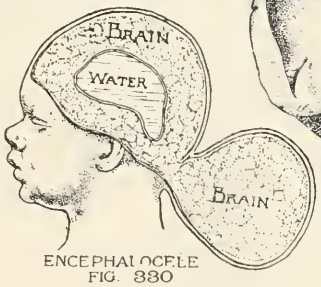
LUMBAR SPINA
BIFIDA
FIG. 327



LUMBAR SPINA
BIFIDA
FIG. 326



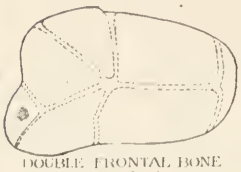
HYDRENCEPHALOCELE
FIG. 329



ENCEPHALOCELE
FIG. 330

(5) ANOMALIES OF CLEAVAGE

TRIPLE TONGUE
FIG. 335



DOUBLE FRONTAL BONE
FIG. 341

DOUBLE HAND
FIG. 331

SUPERNUMERARY FINGERS
FIG. 334

DOUBLE FALLOPIAN TUBE
FIG. 339

SUPERNUMERARY FINGERS
FIG. 333

DOUBLE THUMB
FIG. 332

DOUBLE URETER AND KIDNEY PELVIS
FIG. 338

POLYMASTIA
FIG. 336

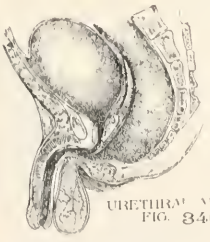
HORSESHOE KIDNEY
FIG. 342

MISSING FINGERS
FIG. 343

DOUBLE GALL BLADDER
FIG. 337

SUPERNUMERARY VERTEBRAE (TAIL)
FIG. 340

(6) VICES OF CONFORMATION



URETHRAL ANUS
FIG. 346

VESICAL ANUS
FIG. 344

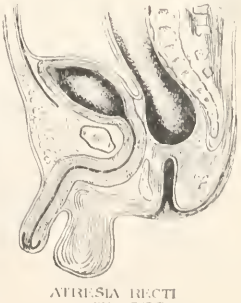
PERSISTENT CLOACA
FIG. 348

SCROTAL ANUS
FIG. 347

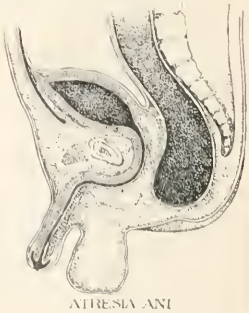
PREPUTIAL ANUS
FIG. 349

VULVOVAGINAL ANUS
FIG. 345

ATRESIA ANI ET RECTI
FIG. 351



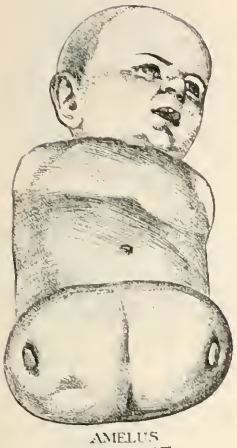
ATRESIA RECTI
FIG. 352



ATRESIA ANI
FIG. 350

ESSENTIAL MONSTERS

1. TERATOMELUS OR LIMB MONSTROSITY



AMELUS
FIG. 357

HEMIMELUS
FIG. 354

PHOCOMELUS
FIG. 353

SYMELUS
FIG. 355

SIRENOMELUS
FIG. 356

2. TERATOCORMUS OR TRUNK MONSTROSITY

CELOTHORUS
FIG. 339

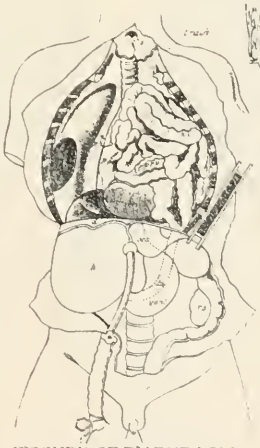
CELOTHORUS
FIG. 359

AGENOSOMA
FIG. 364

CYLLOSOMA
FIG. 363

PLEUROSOMA
FIG. 361

SCHISTOTHORUS
FIG. 338



FISSURE OF DIAPHRAGM
FIG. 362

CELOSOMA
FIG. 360

3. TERATOCEPHALUS OR HEAD MONSTROSITY.

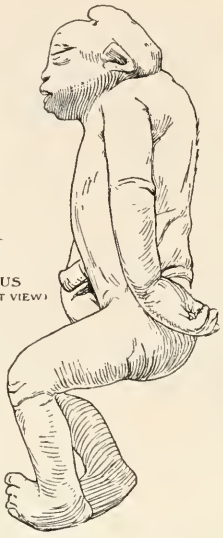
INIENCEPHALUS
FIG. 365

ANENCEPHALUS (FRONT VIEW)
FIG. 366

ANENCEPHALUS (SEEN FROM BEHIND)
FIG. 367

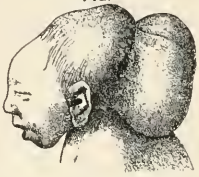
PODENCEPHALUS
FIG. 371

HYPERENCEPHALUS
FIG. 372



PSEUDENCEPHALUS
FIG. 369

PROENCEPHALUS
FIG. 378



NOTENCEPHALUS
FIG. 368

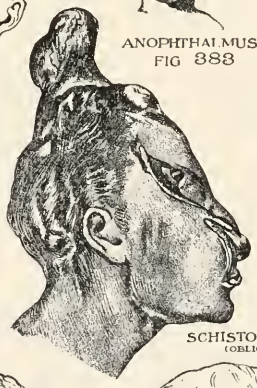
EXENCEPHALUS
FIG. 370

4. TERATOPROSOPUS OR FACE MONSTROSITY.

CYCLOCEPHALUS
(1 COR.)
FIG. 381

ETHMOCEPHALUS
FIG 377

ANOPHTHALMUS
FIG 383



SCHISTOPROSOPUS
(OBLIQUUS)
FIG 374

SCHISTOPROSOPUS
(TOTALIS)
FIG. 375

CYCLOCEPHALUS
(2 CORNEAE)
FIG. 380

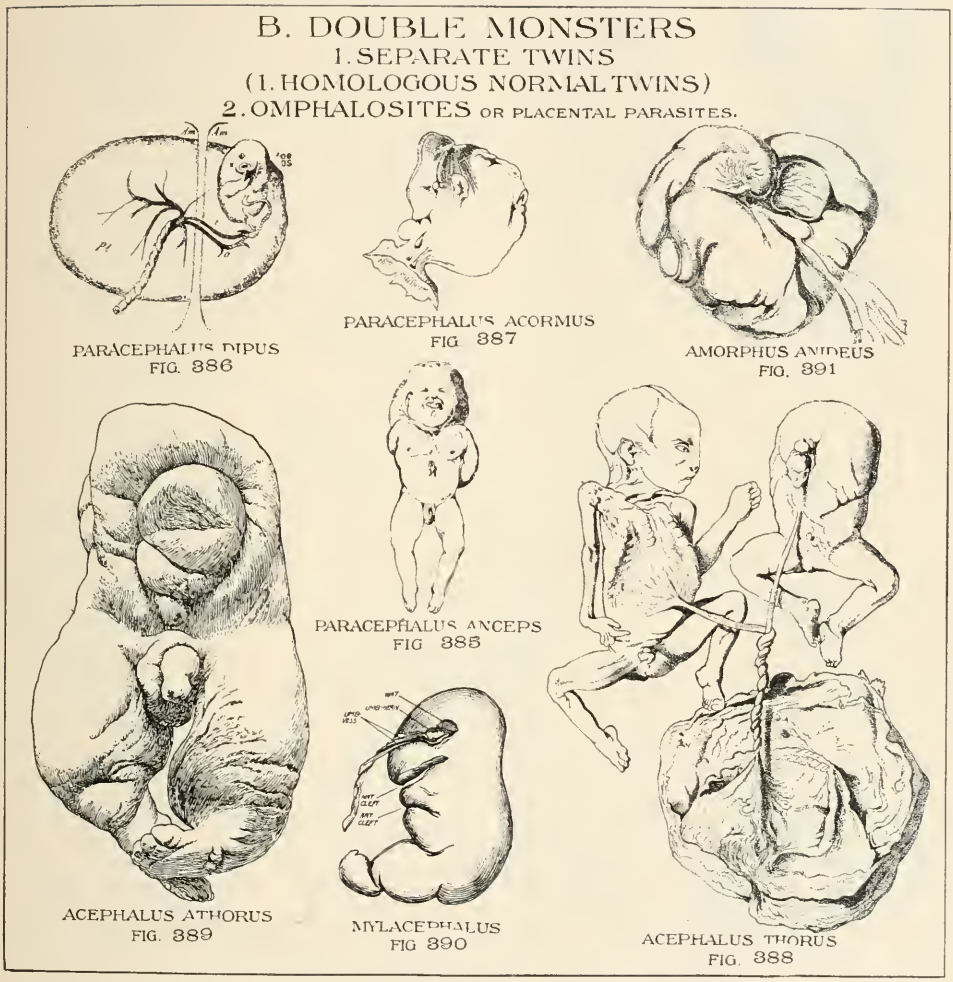
SCHISTOPROSOPUS
(UNILATERALIS)
FIG. 376

RHINOCEPHALUS
FIG 379

CEBOCEPHALUS
FIG. 378

OTOCEPHALUS
FIG. 384

(NO CORNEAE)
CYCLOCEPHALUS
FIG 382



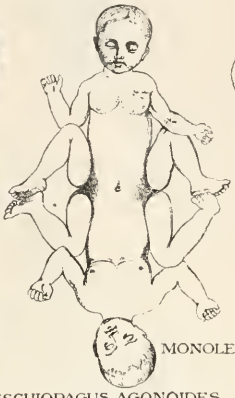
Etymological Key.—PREFIXES: *a-* or *an-*, "absence of"; *syn-* or *sym-*, "fusion," or "blending of two symmetrical structures"; *mono-*, "single," "undivided"; *di-*, "two"; *tri-*, "three"; *anti-*, "opposed" or "opposite"; *tetra-*, "four"; *epi-*, "above"; *hypo-*, "below"; *ectro-*, "abortive," "defective," "rudimentary"; *schisto-*, "cleft"; *micro-*, "small"; *hemi-*, "half." SUFFIXES: *-pagus*, "united," "connected"; *-schistos*, "cleft." PARTS OF BODY: *-cephalus*, "head"; *-cormus*, "trunk"; *-pygus*, "breech"; *-melus*, "limb" ("extremity"); *-thorus*, "chest"; *-notos*, "back"; *-prosopos*, "face"; *-crania*, "skull"; *-rachis*, "spine"; *-lecanus*, "pelvis"; *ischio*, "seat-bone"; *-pus*, "foot," "leg"; *-brachius*, "arm"; *-ophthalmos*, *-opos*, "eye"; *-otos*, "ear."

II. UNITED TWINS

AUTOSITES

1. EPISCHISTOI (CLOVEN ABOVE)

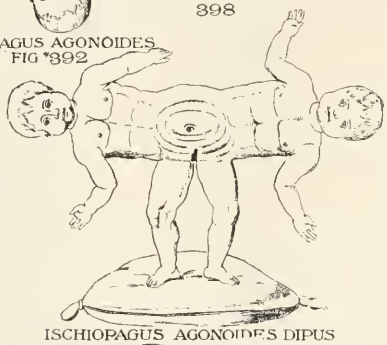
PYGOPAGUS
FIG. 396



ISCHIOPAGUS AGONOIDES
FIG. 392

MONOLECANUS TETRABRACHIUS
398

MONOLECANUS TRIBRACHIUS
FIG. 399



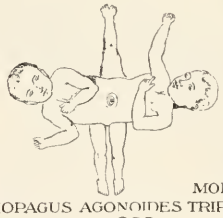
ISCHIOPAGUS AGONOIDES DIPUS
FIG. 394

ISCHIOPAGUS AGONOIDES
FIG. 395

SOMATOPAGUS TRIPUS
FIG. 397

MONOSOMUS TETROTUS
FIG. 404

MONOLECANUS
DIBRACHIUS
FIG. 400



ISCHIOPAGUS AGONOIDES TRIPUS
FIG. 393

MONOSOMUS TETROPHTHALMUS
FIG. 402

MONOSOMUS TRIOPHTHALMUS
FIG. 401

MONOSOMUS TRIOTUS
FIG. 403

2. HYPOSCHISTOI (CLOVEN BELOW)

CRANIOPAGUS FRONTALIS
FIG. 405

CRANIOPAGUS PARIETALIS
FIG. 406

CRANIOPAGUS OCCIPITALIS
FIG. 407

JANICEPS ASYMMETRUS
FIG. 411

HEMIPAGUS SYMPROSOPUS
FIG 408

JANICEPS SYMMETRUS
FIG. 409

JANICEPS ASYMMETRUS
FIG. 410

MONOCEPHALUS DIBRACHIUS DIPUS
FIG 412

MONOCEPHALUS DIBRACHIUS TETRAPUS
FIG 414

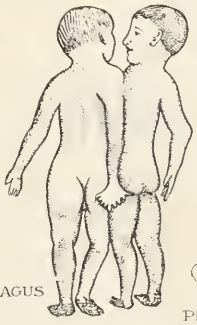
MONOCEPHALUS DIBRACHIUS TRIPUS
FIG. 413

3. AMPHISCHISTOI (CLOVEN ABOVE AND BELOW)

FIG. 415
STERNOPAGUS

XIPHOPAGUS
FIG. 416

DEROTHORACOPAGUS
FIG. 418



THORACOPAGUS TRIBRACHIUS
FIG. 417

PROSOPOTHORACOPAGUS
FIG. 419

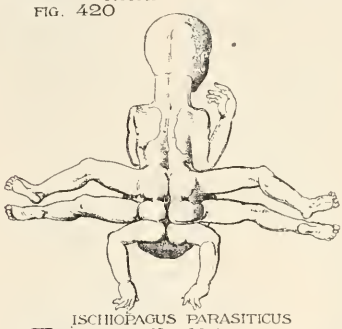
PARASITES.

OMPHALOPAGUS THORUS
FIG. 420

OMPHALOPAGUS ACEPHALUS
FIG 421

OMPHALOPAGUS ATHORUS
FIG. 422

RACHIPAGUS PARASITICUS
FIG. 423



ISCHIOPAGUS PARASITICUS
FIG. 424

CRANIOPAGUS PARASITICUS
FIG. 425

DIPYGUS CEPHALOMELUS
FIG. 426

DIPYGUS THORACOMELUS
FIG. 427

DIPYGUS GASTROMELUS
FIG. 428

DIPYGUS PYGOMELUS
FIG 429

C TRIPLE MONSTERS

TRICEPHALUS.

TRIPLE MONSTER
FIG. 434

EPIGNATHUS
FIG 430

HYPOGNATHUS
FIG. 431

FETAL INCLUSION
FIG. 433

SACROCOCCYGEAL TUMOR
FIG. 432

VII. ANTENATAL DISEASES OF THE FETUS.

1. Infectious Diseases. 2. Acute Poisoning. 3. Chronic Poisoning. 4. Dyscrasic Conditions. 5. Cardiac Diseases. 6. Diseases of the Alimentary Tract. 7. Diseases of the Nervous System. 8. Diseases of the Urogenital Apparatus. 9. Skin Diseases. 10. Fetal Bone Disease. 11. Fetal Traumatisms. 12. Fetal Neoplasms. 13. General Fetal Œdema. 14. Maternal Traumatisms. 15. Maternal Uterine Disease Affecting the Fetus. 16. Fever in the Mother Affecting the Fetus. 17. Death of the Mother Affecting the Fetus.

1. Infectious Diseases.—1. VARIOLA.—When a pregnant woman contracts this disease, one of three conditions may result: (1) Pregnancy is interrupted at the moment of the eruptive period and the woman is delivered of a dead or moribund child that has not been contaminated by the disease. Apparently there has not been time for the latter to develop. This is the commonest termination of pregnancy in a variolous woman. As a variety of the preceding there is occasionally noted a termination in which the child survives. This occurs when labor sets in during the first onset of the disease and also when the type of maternal disease is very mild (varioloid). (2) Pregnancy is not interrupted by the disease. There is a simple coincidence of labor and the mother's disease which supervenes shortly before term, or the pregnancy is continued during and after the subsidence of the disease until term arrives. The children which result from these pregnancies are born intact and it is possible to vaccinate them successfully. The type of maternal disease in this category must be very mild. (3) Pregnancy is interrupted and the child is born with a full variolous eruption. These cases are rare, but many have been placed on record. In a few the eruption did not appear until a few days after delivery. The most remarkable of all cases of intrauterine variola are seen in twin pregnancies in which one twin is born intact while the other has variola. Kaltenbach has even reported a case of triplets in which two of the children were born with smallpox while the third was healthy. Vinay regards this as open to a very simple explanation. A healthy placenta, he states, does not allow disease germs to pass through it. When, however, this organ is the seat of infarcts or other lesions, the natural barrier is overcome. (4) To the preceding categories a fourth may be added; here, while the mother is not known to have had variola, although there may be a history of exposure, her pregnancy is interrupted and the fetus is found to have smallpox. In one such case the mother had had intercourse with a variolous convalescent who was probably the father of the child. This woman was doubtless protected from the disease by vaccination. Vinay is inclined to believe that the maternal immunity in these latter cases is more apparent than real; for in all the recorded instances of variolous pregnancies in healthy women the latter have exhibited headache and backache at the time when the fetus should have been contracting the disease. The mother therefore suffers from the rare form of the latter known as *variola sine exanthema*, in which the entire eruption may be absent, escape observation, or consist only of a few pustules. *Symptoms:* There is absolutely no method by which we can determine the incubation period of fetal variola. The localization of the disease differs considerably from that in the adult, for the face is often spared while the trunk is likely to bear the brunt of the eruption. The eruption may be discrete or confluent, and the disease may actually run its course *in utero*, so that the child is born with cicatrices only. The lesions are umbilicated, but do not, of course, form crusts in a moist medium. When the fetus is first attacked *in utero*, it betrays its distress by violent movement. *Prognosis:* Intrauterine variola is fatal in the great majority of instances. Examples under which recovery occurs have already

been cited. The child is not necessarily still-born, for it may survive for some days. Surviving children are sometimes susceptible to vaccination, but in other cases are refractory. *Treatment:* There is no indication for therapeutic abortion and no management which can be directed especially to the fetus. All pregnant women should be vaccinated when smallpox is prevalent. For treatment of the mother, see Section XV.

2. Vaccinia.—The child borne by a woman who had smallpox during her pregnancy may or may not be susceptible to vaccination. Those who are immune give no evidence of having had fetal variola. Vaccinia can be transmitted to the fetus. Many women are vaccinated during pregnancy and their infants have the same experience soon after birth. The results of different authorities vary somewhat, but, according to Ballantyne, about 33 per cent. of infants are in this way rendered immune. Individual observers place the percentage of immunity as high as 60 per cent. and even 80 per cent. This inherited refractoriness to vaccination is short-lived, so that such infants should by all means be vaccinated as soon as a positive result is obtainable. The claim has been made that unsuccessful vaccination of the mother often confers some immunity on the fetus.

3. Measles.—When a pregnant woman contracts measles, gestation is usually interrupted (in about 75 per cent. of cases, according to limited figures). Children thus born may present a morbillous rash and coryza. Ballantyne, who has seen an undoubted instance of intrauterine measles, cites some twenty others from literature. In each of these the mother herself presented the symptoms of the disease.

4. Scarlatina.—Pregnant women often contract this disease, and may or may not abort. Ballantyne has reported an undoubted case in which the premature infant of a scarlatinous mother was seen to have a rash and enlarged glands on the first day post partum. According to this author, there are about a score of such cases recorded. Vinay also states that healthy children have been born of scarlatinous mothers who have afterward infected the offspring by lactation. In my own case in private practice, scarlatina in the mother resulted, immediately upon the appearance of the eruption, in a seventh-month miscarriage of a dead fetus, the latter showing no evidence of the disease.

5. Erysipelas.—The possibility of the occurrence of fetal erysipelas having been established by certain obstetricians (Kaltenbach, Runge, Stratz), Lebedjeff succeeded in demonstrating the presence of Streptococcus erysipelatis in the chorion. Erysipelas in the mother is not often transmitted to the fetus, and causes abortion in about 50 per cent. of all pregnancies. According to Hofmeier, the fetus exhibits tachycardia when the mother is attacked by the disease, the pulse-rate varying directly with the mother's temperature

6. Diphtheria.—Nothing is known of intrauterine diphtheria. While newly born children have doubtless been contaminated by diphtheritic mothers, it is doubtful if a genuine case of congenital transmission has ever been recorded.

7. Typhoid Fever.—Fetal typhoid is a well-established example of antenatal disease, and has been known since 1840. While the older cases were recognized by the characteristic intestinal lesions, the fetus, as a rule, does not present this localization. After the discovery of Eberth's bacillus diagnosis of fetal typhoid became easier, and still another impetus has been received from the Widal reaction. Pregnant women who contract typhoid fever exhibit a high percentage of interruption of pregnancy, statistics giving the frequency as from 58 to 83 per cent. (Vinay). The study of typhoid fetuses since

the discovery of Eberth's bacillus does not appear to show that the latter causes many lesions, although it is found very widely distributed. In other words, the fetus is the seat of a pure typhoidal sepsis in the majority of cases. Widal's test applied to the fetal blood has given positive results, showing that the antitoxic as well as the toxic principle passes through the placenta. Aside from the occasional occurrence of true typhoid lesions in the fetus, and the common occurrence of a bacillemia or pure sepsis, it is believed by recent observers that the toxins of the disease cause slight but important structural alterations in the fetal viscera, and also retard metabolism and reduce the body-temperature, so that the child, if it grow up, will exhibit dystrophic stigmata, mental peculiarities, deafness, etc. Since the high temperature of typhoid is responsible in part for the frequency with which pregnancy is interrupted, it has been supposed that the Brand method of treatment would reduce this rate. Statistics, however, show very little improvement in this respect.

8. Cholera.—According to Vinay, this disease exerts a more disastrous influence upon pregnancy than any other, variola not excepted. Analysis of many cases shows 53 per cent. of interruptions in which the children are invariably still-born. According to Slavjansky, the placenta exhibits characteristic alterations, due in turn to a specific metritis. Tizzoni and Catani found the comma bacillus in the fetal tissues. The child is invariably expelled shortly after its death, apparently because of the oxytocic action of the cholera virus. Many mothers, however, must die undelivered. Those who survive and whose pregnancies are not interrupted have borne healthy children. Ballantyne cites several instances in which newly born infants were already infected with cholera, although Tarnier taught that intrauterine transmission did not occur.

9. Malaria.—The possibility of fetal paludism has been extensively questioned, but is now generally admitted. Children with enlarged spleens and other evidences of paludism have been born to malarial mothers. The most recent authorities dispute the claim that plasmodium malariæ has ever been found in the fetal tissues. Evidence afforded of intermittent fever in the newly born is open to criticism, because such infants may have been bitten by infected mosquitos soon after birth. Practically, therefore, the diagnosis must be based upon the presence of congenital hypertrophy of the spleen, associated perhaps with dropsical accumulations, extravasated blood, discolored skin, and pigmented white blood-corpuscles. Such children exhibit, in addition, substandard weight, debility, wrinkled skin, pallor, etc. It has been claimed that children born of malarious mothers exhibit almost constant defects in length and weight in comparison with those born of healthy mothers. There is also a very high percentage of interruptions of pregnancy in malarious women, though abortion is not common. Vinay has collected notes of 158 pregnancies with 120 interruptions (about 76 per cent.); but of this number there were but 20 abortions, the remainder representing premature deliveries. Hence, statements which relate to small size and debility of the newly born may be explained largely by prematurity. Malaria has, *per se*, a marked tendency to bring on delivery ahead of time, and since quinine is a specific for the disease, the good it may do will greatly outweigh the prospect of an occasional assertion of an oxytocic action.

10. Influenza.—Epidemic influenza is responsible for many premature births; failure of such children to survive should not be attributed to congenital transmission when we bear in mind the high mortality of prematurity in general. In regard to the possibility of actual transmission of the disease, Ballantyne states that he has had several personal cases of influenza contracted *in utero*.

11. Fetal Sepsis.—If the mother is in a state of sepsis from pneumococci, streptococci, staphylococci, or Bacillus coli, and the placenta allows them to pass into the fetal circulation, a condition of intrauterine sepsis necessarily results, and some of the fetal organs will probably be attacked. *Pneumococcus sepsis, fetal pneumonia:* Pregnant women with pneumonia frequently abort, and, according to Vinay, 60 per cent. of their infants born alive die shortly after birth, presenting at autopsy evidences of pulmonary hepatization. The sooner delivery can occur after the mother is attacked, the more likely are the children to survive. The claim that these alterations in the lung are pneumonic has been disputed in the belief that the fetus undergoing air-hunger from the maternal pneumonia attempts inspiration and aspirates amniotic fluid, as a result of which the lung presents a characteristic appearance at autopsy. Admitting the probability of this claim, it is still certain that fetal pneumonia may occur as a feature of pneumococcus sepsis. *Streptococcus sepsis:* Streptococcus pyogenes has been found in the blood and tissues of the fetus in connection with various fetal diseases of the mother. Most recorded cases appear to be examples of pure sepsis without lesions. The streptococcus of erysipelas appears to have caused fetal endocarditis and other lesions, and Moncorvo thinks that congenital elephantiasis may originate in this way. *Staphylococcus sepsis:* The staphylococcus has been found in fetal tissues in a case of typhoid fever. If acute articular rheumatism, as has been claimed, is due to the staphylococcus, the few recorded cases of fetal rheumatism may be cited in this connection. *Bacillus coli sepsis:* Ballantyne states, without references, that Bacillus coli has been found in the fetus.

12. Miscellaneous.—*Anthrax* has been transmitted from the mother to the fetus in a few instances, the bacillus of the disease being recognized in the fetal tissues. *Hydrophobia* is transmissible by animal experiment, but fetal hydrophobia in mankind has never been described. *Tetanus:* We know of no case of association of tetanus in the mother with trismus in the newly born. Naturally, in the vast majority of recorded cases of the latter the fetus was not exposed to infection from the mother. *Yellow fever:* Pregnant women with this affection often abort. When they recover without miscarriage, the children afterward born are said to be immune to the disease. This statement, made upon the authority of individual observers, is not generally credited. *Relapsing fever* is known to be transmissible to the fetus. According to Kleinwächter, there is a fetal *typhus*. Ballantyne mentions a fetal *varicella*. Kəlnwächter mentions fetal epidemic *parotitis*. Fetal *pertussis* is mentioned by Ballantyne. Of epidemic *cerebrospinal meningitis* a single case is on record (Ballantyne).

13. Tuberculosis.—When a consumptive woman becomes pregnant, she tends to abort in proportion as the disease is advanced. Thus, it has been computed that about 15 per cent. of abortions occur in the first, and 33 per cent. in the second, stage of phthisis. When the pregnancy is not interrupted, the offspring of these women are usually delicate and undersized, and after developing the so-called strumous or tuberculous diathesis, they tend to fall a prey to the disease. Before the discovery of the infectious character of tuberculous matter and the specific germ of the disease, it was generally believed that the phthisical individual practically acquired the disease *in utero*. The apparent relative immunity of the fetal and placental tissues toward direct implication in the tuberculous processes has, however, led to the conviction that antenatal infection is a mere curiosity in pathology, and that the mother transmits to her fetus nothing more than a lack of resistance to disease. There is a species of fetal tuberculosis that may be of common occurrence. The toxic products of the

disease, circulating in the maternal blood, should certainly be able to enter the fetal vessels, and there give rise to a train of symptoms similar to those which follow injections of tuberculin in large doses. It can hardly be doubted that exposure to this influence often causes fetal death, especially in the later months of pregnancy; while those children who do not die *in utero* exhibit at birth the delicacy and undersize already mentioned. The fact that bacilli are seldom found in the blood of tuberculous individuals, and then, as a rule, only in miliary tuberculosis, furnishes a strong argument against the existence of bacillary emigration from the mother to the fetus even if the placenta were permeable.

Actual Fetal Tuberculosis.—This condition has been recognized a very few times only (between twenty and thirty). There are two distinct types: viz., simple bacillosis without lesions, and tuberculosis proper. In the former the fetal tissues are shown to contain bacilli by the microscope, by culture, or by animal inoculation. In the latter tubercles are recognizable. According to some authors, the lesions are almost necessarily located in the organs first traversed by the placental blood, especially the liver and spleen. This claim remains to be proved, as a great variety of organs may be attacked by the disease. In some of the cases the placenta or endometrium was also tuberculous, but there is no necessary relationship in this particular.

The great infrequency of fetal tuberculosis is to be explained as follows: Cases are undoubtedly overlooked, and some pediatrists—Holt, for example—are inclined to look upon cases of tuberculosis in extremely young children as of fetal origin. But even with this concession the disease is notably rare, because two conditions are doubtless indispensable factors in its production: (1) The mother must be suffering from general miliary tuberculosis, otherwise her blood will contain no bacilli; and (2) the placenta must be the seat of some lesion whereby the bacilli are suffered to enter the fetal blood.

The possibility that fetal tuberculosis may be derived from a tuberculous ovum, or even infected spermatozoa, has been subjected to experimental testing in animals. Paternal infection has been deemed impossible, but contamination through the ovum is regarded as a possibility. Tuberculosis of the ovary is now known to occur frequently, and in some cases the disease has even appeared to attack the Graafian follicles by preference. As to the fate of an ovum proceeding from such a follicle we can only make conjectures. Statistics appear to show that early abortion occurs very rarely in tuberculous women, but these figures are based on pulmonary tuberculosis only. Genital tuberculosis is, of course, a different type of disease.

14. Syphilis.—Fetal syphilis—*i. e.*, syphilis which asserts itself during the fetal period for the first time—must be distinguished from syphilis which is contracted perhaps during fetal life, but on account of the prolonged incubation period does not assert itself until after delivery—usually not until the second month of extrauterine life. We know little of germinal and embryonal syphilis. Antenatal syphilis, then, is to-day synonymous with fetal syphilis. The effects of the syphilitic poison or poisons upon the fetus are, speaking broadly, the same as those seen in adult life: viz., specific and non-specific, or, in other words, syphilitic and parasyphilitic. The latter changes in the fetus are essentially dystrophic, and comprise a long series of modifications of development in various organs and tissues. All the structures which make up the ovum may be attacked by the disease—fetus, liquor amnii, membranes, cord, and placenta. The specific alterations induced by fetal syphilis are, in brief, as follows: *Liver:* While this may escape injury, it is very commonly affected, being enlarged and hardened and strewn with whitish dots. These

changes are the results of a diffuse interstitial cirrhosis, the white granules consisting of miliary gummata. Larger gummy nodules are seldom seen in the fetal liver. *Lungs:* These are often the seat of interstitial pneumonia and miliary gummata, the changes being analogous to those found in the liver. The so-called white pneumonia which is sometimes encountered consists of patches of air-cells filled with epithelial debris in a state of fatty degeneration. *Heart and Vessels:* The heart is seldom attacked beyond the deposition of a few miliary gummata, but the vessels are usually the seat of generalized periarteritis and endarteritis with resulting obstruction of the lumina of the vessels attacked. *Thymus:* The lesions of this organ, largely cystic, do not appear to be specific in character. *Kidneys:* These organs are not usually implicated by the disease. *Intestines:* Fetal peritonitis is largely of syphilitic origin. *Osseous System:* The diaphyses and epiphyses of the long bones are separated by a peculiar linear tract which is of varying breadth, yellow, and irregular (Wegner's line). This formation represents the occurrence of syphilitic osteochondritis. The peculiar color is due to the fatty or cheesy metamorphosis of the products of inflammation. *Integument:* The bullæ of pemphigus of the newly born may develop *in utero* as a part of the fetal evolution of the disease. This is also true to a limited extent of moist papules, condylomata, etc. A pseudo-ichthyotic condition of the skin representing extensive desquamation is sometimes seen. The changes which occur in the fetal appendages are described under the disease of the latter.

Transmission.—There is no necessary connection between the date upon which the germ first attacks the fetal tissues and the period of an explosion of symptoms. The fetus may contract the disease, but it may be the newly born or older infant that first exhibits the specific lesions. Or the ovum may contract the disease and the fetus suffer from it. In describing fetal syphilis we must confine ourselves largely to the outbreak itself. We must also bear in mind the non-specific lesions from which the fetus may suffer. (1) To take the most familiar conditions conceivable in this connection, let us suppose that a woman some months pregnant undergoes an explosion of secondary syphilis of a severe type. The placenta is attacked along with most of the other tissues of the body, and the fetus dies before it has time to share the maternal disease. This is the most common type of the relations which subsist between syphilis and the fetus, and corresponds to the great frequency of abortion and miscarriage in syphilitic women. Children born under these circumstances should have nothing peculiar in their appearance. (2) If the fetus is not killed outright, it is almost certain that the germs of the disease will traverse the placenta and set up some of the visceral changes which have already been indicated. Unless this infection occurs near term, a fetus thus rendered profoundly syphilitic is very likely to die *in utero* from the disease itself; and when expelled, it will present a typical picture of fetal syphilis, including maceration. If such a child is born alive but hopelessly diseased, we have the so-called *syphilis neonatorum*, which should not be confounded with infantile syphilis proper, which represents the outbreak of an infection received *in utero*. (3) If the germs of the disease do not traverse the placenta, at least at the outset, the fetus is exposed to the toxic principle of the disease as it circulates through the maternal blood, and, even aside from this, it must perhaps suffer to some extent from the anemia and malnutrition of the mother which are due to the action of this poison. Directly and indirectly, then, the fetal development is more or less interrupted, just as it would be in tuberculosis, alcoholism, etc. The fetus may be born in this condition alone, or, as is much more likely,—at least early in the maternal disease,—some of the maternal germs finally penetrate the placenta. The fetus when

born is found to be small and feeble, with certain evidences of prematurity, not yet syphilitic perhaps, but containing the germs of the disease. After several weeks of extrauterine life the disease becomes active, and the usual phenomena of secondary syphilis develop. This is the familiar type of *congenital, hereditary*, or *infantile syphilis*. In some cases the activity does not occur until late in childhood or even until adolescence (tardy hereditary syphilis); such individuals are peculiarly afflicted with the evidences of dystrophy of syphilitic origin. (4) As intimated, it is possible for a fetus to escape bacillary infection *in utero*, and develop no syphilitic lesions in after years, although the child may present evidences of dystrophy. (5) Finally, it is possible for an infant to escape syphilis *in utero* altogether—not only its specific but non-specific influence. All the preceding types may occur in the pregnancies of one woman. It is impossible in a work of this sort to enter into the discussion of such subjects as direct paternal infection, syphilis of the unimpregnated ovum, infection of the mother from the fetus, immunity, Colles's and Profeta's laws, etc. Syphilis contracted before or near the time of conception is said to be more generally fatal to the fetus than when the mother is infected some weeks or months after impregnation has occurred; that is, the proportion of abortions and of fetal syphilis will be higher in the former case.

Treatment.—The mother of course requires treatment for syphilis, and there is no special indication for the treatment of the fetus. Mercury and potassium iodide should be given as early as possible and continued throughout pregnancy. Very recently an attempt has been made to treat the fetus locally by the use of medicated tampons introduced into the vaginal vault. The mercury was used in the form of ointment, mixed with an equal or a double quantity of cocoa-butter (Riehl). In theory a special indication should exist for the fetus when a syphilitic husband has impregnated his wife. In these cases the fetus is supposed to infect its mother, and proper local medication might prevent this catastrophe if it really ever occurs. Riehl's method would be applicable here, but a more rational treatment would be to empty the uterus at once. In regard to the routine practice of abortion in syphilis, the chance of curing the fetus is so considerable that it is contraindicated as a general resource and is indicated only under special contingencies.

2. Acute Poisoning.—*Chloroform:* There is no longer any doubt that chloroform used as an anesthetic in labor tends to cause fetal asphyxia. This is demonstrated by the results of Cæsarean section, and is, in fact, something of a contraindication to the use of anesthesia in labor. Chloroform has never been recovered from the fetal blood. Fehling believes that it can determine the presence of fetal icterus and albuminuria. *Ether:* What has been said of chloroform applies equally well to ether. (See Anesthesia in Obstetrics, Part X.) *Coal-gas:* The pregnant woman sometimes inhales this gas with or without suicidal intent. In cases in which the mothers escaped death they sooner or later were delivered of dead or macerated children. This gas is extremely poisonous to the fetus. Nevertheless there is no evidence that the gas enters the fetal circulation to any extent. *Alcohol:* Cases are upon record in which the ingestion by pregnant women of an inordinate amount of alcohol has apparently caused fetal death. *Mineral Acids:* In cases of acute poisoning with sulphuric acid the fetus appears to have shown some of the dehydrating action of this substance, but only in its skin, which is hard and brown. *Metalloids:* In *phosphorus*-poisoning the fetus shows very much the same lesions as the mother, it being certain that this substance passes through the placenta. In

acute *arsenical* poisoning, however, the ovum gives no evidence that this drug reaches the fetal tissues.

3. Chronic Poisoning.—*Plumbism:* In pregnant women suffering from chronic lead-poisoning abortion occurs in no less than 60 per cent. of cases, and children born alive have a high secondary mortality and exhibit a marked tendency to convulsions and hydrocephaloid or rachitiform malformations of the head. The latter inheritance may even proceed from the father alone. When both parents are affected, the child morbidity is increased. It is not known to a certainty whether the lead kills the fetus outright or simply excites labor. The metal has been found in the fetal viscera, where it has apparently set up inflammatory disturbances. On the other hand, preparations of lead have a notorious tendency to produce abortion, and are much used with this criminal intent. *Mercurialism:* In pregnant women who are subject to chronic mercurialism the tendency to abortion and premature delivery is high, although the exact ratio is unknown. When syphilis is present, large medicinal doses of mercury are known to prevent abortion. The metal has been found in the fetal tissues. A curious fact repeatedly noted is the improvement in health which follows pregnancy in these cases. Thus, a worker in a mirror or barometer factory may have her salivation, tremor, etc., disappear after conception, to return when abortion has occurred. This apparent protecting action of the embryo suggests Colles's law of maternal immunity in syphilis. The action of mercury upon pregnancy seems to be less severe than that of lead. *Phosphorism:* De Caulbry, Borri, and others state that pregnant workers in match factories undergo abortion very frequently. But few data are available regarding chronic phosphorus-poisoning. *Arsenicism:* We know even less of arsenic than of phosphorus in regard to the effects of chronic maternal poisoning upon the fetus. *Alcoholism:* It was not until 1900 that Nicloux* was able to demonstrate that the drug in question enters the fetal circulation. He gave a woman milk-punches after she was well along toward delivery, and was able to distil some of the alcohol from the blood of the umbilical vein. In regard to the effects of alcoholism on pregnancy, as studied in a series of chronic drunkards,† there is no evidence of any strong tendency to abortion. Still-birth is quite common, but the principal effect of alcohol upon the fetus is shown in the extraordinary tendency to nervous and cerebral disease, malformation, and degeneracy exhibited by these children as they grow up. Alcohol in the fetal circulation tends to arrest the highest development. *Morphinism:* In pregnant morphinomaniacs no especial tendency to abortion or premature delivery has been noted. The children born to such women often appear healthy in every respect. Morphin, however, has been recovered from the fetal tissues. There is considerable evidence that such fetuses are more likely than others to require resuscitation at birth. I have observed that attempts at withdrawal of the morphin during gestation have been followed by excessive fetal movements, which subsided when the use of the drug was renewed. This phenomenon suggests that the fetus has acquired a tolerance to the narcotic. *Nicotinism:* The pregnancies in many tobacco factories, etc., are not interrupted, although there is a very high mortality among the children of these women.

4. Dyscrasic Conditions.—*Diabetes:* Fetal diabetes is not actually known to exist, but the sugar in the maternal blood may be able to pass into the circulation of the fetus and give rise to various disturbances. Sugar has been found in the amniotic fluid in cases of diabetes, and also in the urine of the new-born. Artificial (phloridzin) glycosuria in the mother causes sugar to appear in the

* "L'Obstétrique," 1900, t. v. † Sullivan: "Jour. Mental Science," 1899.

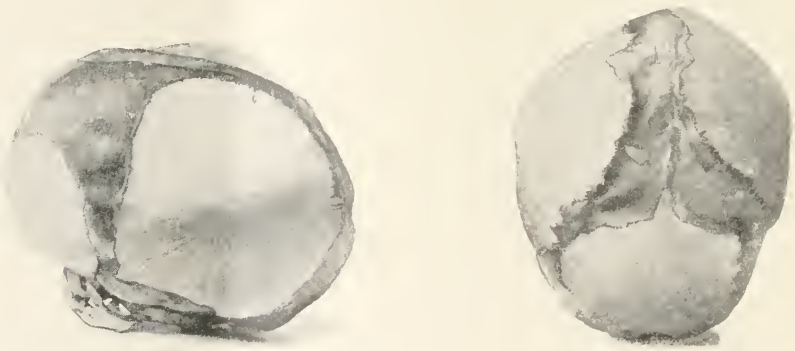
fetal urine. According to Vinay, pregnancy in diabetic women is interrupted in over a third of the cases, while about one-half of the children born alive do not survive; but this need not be due to the sugar directly, because diabetes often leads to disease of the endometrium. *Albuminuria, Renal Disease, Toxemia of Pregnancy, Eclampsia of the Mother:* The children are often still-born or die soon after birth. All in all, the chance of survival of these children is very small. They are undersized and below weight, even when fully matured. They are very prone to be seized with convulsions after birth, and, according to some, even *in utero*. Autopsies upon many of these fetuses have revealed no constant pathological changes. In fact, the obscurity which attaches to the entire problem of eclampsia, etc., in the mother, extends to the fetus. (Compare Section X, Part III.) *Leukemia:* Women with this affection seldom become pregnant. In the few recorded cases the infant was sound. *Cancerous Cachexia:* Still-births are very common, while children born alive are very weakly and in many cases succumb soon after birth. The toxins which must be present in the maternal blood appear to exert an influence on the fetus which is similar to that observed in tuberculosis.

5. Cardiac Diseases.—*Endocarditis:* Its presence is revealed by changes analogous to those of the same disease in extrauterine life: viz., thickening of the endocardium, contraction of the orifices, and valvular lesions. The causes are very obscure. The clinical features of this affection are as interesting as its pathogeny is obscure. It has been diagnosticated a number of times during intrauterine life through auscultation of the fetal heart, systolic murmurs having been readily apparent. Auscultation after delivery gave the same sounds in living children, while autopsy confirmed the diagnosis in the case of non-survival. The presence of a uterine souffle under these circumstances might readily produce an illusion. As with so many other presumably fetal diseases, it appears quite probable that what is called fetal endocarditis represents an embryonal anomaly. Fetuses with this affection are very prone to exhibit one or more malformations of other tissues (hare-lip, cleft palate, imperforate anus, horseshoe kidney, Mongoloid idiocy, etc.). *Atheroma:* At least one case of atheroma of the aorta and pulmonary artery is known. The fetus was premature and survived about two weeks. It is hardly possible for such a condition to develop in so short a time after birth.

6. Diseases of the Alimentary Tract.—*Ascites:* As a rule, this condition is due to fetal peritonitis, and is thus a result of disease. It is considered to some extent under "Dystocia of Fetal Origin." *Peritonitis:* This disease is usually, but not necessarily, accompanied by effusion (see Ascites). The adhesions which form may cause various late malformations in the abdominal cavity. Fetal peritonitis may be due to hydramnios or syphilis, but in very many cases appears to have arisen idiopathically or from unknown maternal causes. *Congenital Obliteration of the Bile-ducts:* This interesting affection is one of the best examples of the diseases of the fetal period. It appears to be analogous to biliary cirrhosis of the liver in adult life. The initial process, the nature of which is unknown, leads to obstruction of the biliary passages, which is accompanied or followed by cirrhosis of the liver and jaundice. The fetus is born with icterus, and the condition is thus one of icterus neonatorum, under which name it is fully described (Part IX). *Congenital Hypertrophic Stenosis of the Pylorus:* This belongs clinically under the diseases of the newly born, but undoubtedly develops *in utero*. It possesses a nervous or spasmodic element which precedes or is associated with hypertrophy of the pylorus and the wall of the stomach. Something analogous to this union of nervous spasm and hypertrophy is seen in the urethra

and bladder, also the colon. *Miscellaneous:* Ballantyne, in addition to the congenital hypertrophy of the colon, speaks of a "congenital volvulus."

7. Diseases of the Nervous System.—*Congenital Hydrocephalus* (Figs. 435 and 436).—*Definition:* An excessive accumulation of cerebrospinal fluid within the brain or its membranes, causing enlargement of the skull. The serous effusion is generally confined to the ventricles, although it may be found in the interstices of the pia mater, in the parenchyma of the cerebrum, or between the arachnoid and the dura mater. (See also "Dystocia of Fetal Origin," Part V.) *Frequency:* This affection is rare, occurring once in about 3000 deliveries. *Pathology:* The skull becomes enlarged, sometimes enormously so, by the pressure of the increasing quantity of the fluid, and the edges of the sutures are separated more or less widely; the bones become very thin, sometimes like parchment; the skull is much larger proportionately than the face, the forehead being especially prominent. The head may even reach the size of that of an adult; the body, as a rule, is normally developed, and is of the size which corresponds to the period of pregnancy, but is often wrinkled and emaciated. Other malformations, as meningocele, frequently coexist, and hydramnios is a common



FIGS. 435 AND 436.—HYDROCEPHALUS. TWO VIEWS OF THE SAME SKULL. (⅓ natural size.) —(*Author's collection.*)

accompaniment. The quantity of liquid in the ventricles may reach several pints. The head is shaped like a wedge, with the base upward; the characteristic deformity produced by the normal size of the face and lower part of the skull, surmounted by the enormously distended upper part, is very striking. The eyes are very deeply set, and their axes point obliquely inward, so that they look crossed, and the deformity is often hideous, from the prominence of the eyes and the overhanging forehead (Fig. 435). With this affection polyhydramnios is commonly present, but rarely will hydrorrhachis be found. There is a decided tendency, on the part of the mother, to rupture of the uterus. *Etiology:* This is not positively settled. It has been observed to occur several times in children of the same mother: in one case six (Göhlis); in another seven (Peter Frank). Very rarely have abnormal conditions been found in the mother. Frequent anomalies are present in the fetus itself and its surrounding parts; namely, spina bifida, club-foot, large quantities of liquor amnii, anasarca and ascites, and congenital rickets. Most of these defects are due to the same cause as the hydrocephalus. Then, too, may occur diaphragmatic hernia, absence of one kidney, etc. (Winckel). *Diagnosis:* The condition is seldom recognized during pregnancy. In a small proportion of cases hydramnios coexists. Vicious

presentations are often present. Exceptionally certain phenomena have led to the making of a diagnosis, such as the absence of ballottement and parchment-like crepitation and fluctuation in the fetal head. (See Fetal Dystocia, Part V.)

Meningocele; Encephalocele; Hydrencephalocele.—Meningocele (Fig. 328) consists in hernia or tumor in which there is a protrusion of the cerebral membranes through an opening in the skull. These form a sac, which may or may not contain cerebrospinal fluid. In *encephalocele* (Fig. 330) there is a protrusion of the brain substance which is connected with the bulk of the brain by a constricted neck or pedicle. In this tumor there may or may not be fluid. In *hydrencephalocele* (Fig. 329) there is a protrusion of a portion of the brain substance, as in encephalocele, but this contains within its center a cavity filled with cerebrospinal fluid and communicating with the distended lateral ventricles of the brain.

Meningocele is rarer than meningo-encephalocele. The occipital and fronto-nasal regions form the most frequent seat of these tumors. The size varies from that of an olive to an egg-plant. The tumor is always congenital; generally it is round and elastic, soft and fluctuating. Its reducibility varies. It is always in or near the median line. There is pulsation synchronous with that of the heart. Convulsions or even coma may be caused by compression. These deformities probably result from an arrest of development of the cranial bones. They may be due to arrested or defective development, or they may result from an intracranial inflammation, terminating in bands of adhesion, or to a thinning of the bones of the skull from internal hydrocephalus. The head itself may be normal or hydrocephalic. Coincident with these tumors is a softening of the cranial bones, which renders expression of the head easier in labor. They do not often offer an obstruction to delivery, for, on account of their position, they are expelled either before or after the head itself. The maximum degree of obstruction will obtain when the tumor is of large size, with short pedicle and a lateral position. Prognosis for both mother and child is much better than in cases of congenital hydrocephalus. All difficulty in the expulsion of the fetus is, as a rule, obviated by puncture of the sac. After birth the tumor should be carefully guarded from any friction or injury. (See Fetal Dystocia, Part V.)

Spina Bifida (Figs. 335, 336, 337).—This is a defect in the vertebral canal, which consists of a fluid tumor formed by the protrusion of some part of the contents of the canal. It is found at any point of the spinal column, but most frequently at the cervical or near the end of the dorsal region. Among the congenital deformities it is one of the most frequent. Spina bifida is thought to be due to early arrested development, taking place generally before the segmentation of the cord. Since the dorsal vertebral arches fuse more rapidly than the cervical or lumbar, there is more opportunity for the defect to occur in the two latter regions. There are two degrees of this malformation: (α) *Hydrorrhachis externa*—in which the liquid is between the cord and its envelopes or in the midst of the cord in the ependymal cavity; (β) *Hydrorrhachis interna* constitutes a meningocele. In hydrorrhachis interna the tumor contains not only the cord but also the spinal nerves arising from it. The tumor is, as a rule, associated with spina bifida, though this is not always the case. It may be sessile or pedunculated, depending upon the extent of the fissure. The latter may be in the vertebral bodies or the tumor may protrude through the intervertebral notch or foramen, and point anteriorly—*spina bifida occulta*. Although the tumor is most often single, it may be multiple or it may exist in two regions of the canal at the same time. It may be formed before the closure

of the central canal, or even later, the accumulated fluid causing it to open again. Its size varies considerably, though it is often about the size of a nut. Any effort at crying or standing distends the tumor. *Prognosis:* Early death is frequent, although the victims of this infirmity have been known to reach fifty years of age. The prognosis is greatly influenced by the anatomical variety and by the complications. The simple meningocele when covered by skin is the most favorable form. Indeed, complete recovery may be hoped for. In some cases hydrocephalus has been known to develop after cure of the original deformity has been obtained by operation. The *diagnosis* is not difficult as to recognition of the general condition. It is not so easy to distinguish the different varieties. *Treatment:* If the malformation is not extreme, the treatment should be expectant. Inflammation often follows injections into the sac or excision of the sac. The tumor should always be protected from pressure, and if it is not covered by integument the surface must be kept aseptic. For details of the operation a work on operative surgery should be consulted.

Cerebral Diplegia: While congenital spastic rigidity, or Little's disease, is usually held to have an intra-partum origin, it is by no means certain that there is not in some cases an antenatal element. *Chorea:* This affection can sometimes be diagnosticated ante partum through the choreic movements of the fetus. In such cases we often find a history which might in part account for the affection, such as history of maternal fright or fall, alcoholic or epileptic inheritance. But chorea is sometimes hereditary, and even a distinctly family malady, which peculiarity has been remarked in some of these intrauterine cases. A distinctly hereditary affection has nothing to do with the fetal stage of intrauterine life, hence chorea from this standpoint could not be placed among fetal diseases. The same is true of such affections as Friedreich's ataxia, Thomsen's disease, etc. *Maternal Impressions:* The nervous system of the mother is easily excited, a very slight irritation being capable of arousing contractions of the uterus. The effects on the fetus of disturbances of the maternal nervous system are probably most common in the case of women with highly developed nervous organizations. The *modus operandi* of these phenomena is not yet clearly understood. Although there is no apparent nervous connection between mother and child, there may be an alteration in the blood caused by profound nervous disturbance analogous to the decomposing effect of an electrical current on a chemical solution. This view would be somewhat supported by the well-known fact sometimes observed in women whose milk, as a result of strong emotion, becomes a rank poison to the child. Maternal impression is as yet a mooted question, and reliable literature on it is deplorably deficient. However, much has been written on both sides, and arguments and examples have been brought forward which, in their turn, would seem to almost prove the opposed views. The affirmative side of the subject has been espoused from the earliest historical period. Instances pointing to the connection between or the dependence of congenital deformities, both physical and mental, upon maternal impressions are too numerous to be completely dismissed as coincidences. On the other hand, two of the strongest arguments opposing this view have been advanced as: (1) the lack of nervous connection between mother and fetus and (2) the alleged cause of the anomaly generally takes place at a period not coincident with that of the embryonic evolution of the part affected. The whole subject is at present in an uncertain state. *Hereditary Predispositions of the Fetus:* Syphilis with its effects on the fetus has already been noticed. There are certain deformities which belong to certain families as an inheritance ("recur-

rent deformities"). These may be serious enough to cause death. One strange affection that has been noted is the thickening of the fibrous and muscular tissue of the umbilical vein, which diminishes the calibre to such an extent that several fetuses affected in this way were born dead. They belonged to the same mother (Leopold).

8. Diseases of the Urogenital Apparatus.—*Nephritis:* In dropsy, anuria, etc., of the newly born the question of the existence of intrauterine nephritis naturally arises. Cases in which the children thus affected are born alive have thus far been inadequate for the solution of the problem. Thus, in an observation cited by Ballantyne the child did not become dropsical until the second day after birth. It survived three weeks. The existence of fetal nephritis must be determined largely from a study of unborn or still-born children. *Vesical Distention:* This is also considered among the causes of dystocia of fetal origin (Part V). In any case it is hardly a fetal disease nor due to a disease, but rather a condition associated with various malformations, some of which are responsible for its existence. Ballantyne makes a special variety of the type which is due to obstruction within the urethra and which causes extreme thickening of the bladder walls and the ureters. In some of these hypertrophic cases, however, no obstruction can be found, so that the existence of a spasmodic stenosis must be assumed, and it is this factor which permits us to place the affection among true diseases. *Hydronephrosis:* This condition, the result of embryonal malformations, is considered under "Dystocia of Fetal Origin" (Part IX). *Cystic Degeneration of the Kidneys:* The nature of this condition is obscure. If due to a sclerogenous inflammation of the urinary tubules, it would be a disease, otherwise it would have to be placed with fetal neoplasms of embryonal origin. It is considered under "Dystocia of Fetal Origin." *Diseases of the Genitals:* These organs, representing a persistence of embryonal structure during the fetal period, are subject to malformations rather than diseases. A congenital prolapse of the uterus is known to occur, almost always in association with spina bifida, and is described in great detail by Ballantyne. A red mass is seen to project from the vulva at birth.

FIG. 437.—FETAL ICHTHYOSIS.—(*Kyber's case.*)

9. Antenatal Cutaneous Diseases.—There may be a failure of development in any one or all of the specialized structures of the skin, evident at birth, as happens in the case of other organs. When the lack is total (*e. g.*, atrichia), it is apt to be accompanied by other deformities. More or less localized aberrant growth is shown in the formation of nævi of various sorts—vascular, pilary, pigmented, papillomatous, verrucous. Aside from these tumors, the commonest misdirection of the great embryonic cellular activity is in an increase of the surface layers of the epidermis, the stratum corneum particularly, which is called *ichthyosis*. There are two varieties, one which is congenital and one which develops after a few years have passed.

(1) ICHTHYOSIS CONGENITA (*Hyperkeratosis Congenitalis, Harlequin Fetus, Universal Congenital Keratoma*) (Fig. 437).—The children are usually premature and immature. They rarely survive more than a few days, but Sherwell has seen one child live as long as five months. The skin is covered with polygonal horny plates, one-sixteenth of an inch or less in thickness, closely adherent and

separated from each other by deep furrows, which in the neighborhood of the orifices may extend into the cutis and consequently bleed. *Prognosis*, of course, is unfavorable.

(2) Keratolysis Exfoliativa is a congenital affection described by Sangster. In it a condition obtains in which the loosened horny stratum comes away in large thin flakes, and leaves a reddened prickle-cell layer, indicating a lack of the normal adhesive quality between the epidermic cells. The affection is excessively rare, and is not very remotely related to ichthyosis, at least so far as the histology goes.

(3) General Cystic Elephantiasis.—This affection is thought to possess a close relationship with general fetal dropsy, although it may also be allied to localized forms of elephantiasis (Fig. 438).

Fig. 438.—General Cystic Elephantiasis. —(*Ballantyne.*)

10. Fetal Bone Diseases.—The skeleton diseases of the fetus represent but a single basic condition: viz., irregular or imperfect ossification (Fig. 439). In virtue of the great mass of names which have accumulated in the literature of this condition, Ballantyne proposes to abolish them all and describe a single affection which occurs in four types. Thus, *Type A* consists essentially of a softening of the bones, betrayed by the presence of craniotabes and curvature of the long bones. Type A resembles extrauterine rickets more than any other fetal bone disease. *Type B* exhibits a great fragility of osseous tissue, as well as curvature and shortening of the long bones. The latter fracture from simple manipulations. While these two types have more or less resemblance, *Type C* is radically different, being characterized by extreme overgrowth of the epiphyses of the long bones. The diaphyses appear correspondingly short. This hyperplasia of the cartilaginous epiphyses of fetal life must be related in some manner to the enlargement of these portions of the skeleton in extrauterine rickets. This type of fetal bone diseases has been known as chondrodystrophia fœtalis. *Type D* is in some respects the converse of the preceding, and is usually known as achondroplasia. It is seated chiefly in the limbs and trunk, the head being approximately normal. The disorder is essentially defective endochondral ossification. The diaphyses of the long bones are reduced in length from a half to a third, the epiphyses being normal. This is the most striking feature of the disease. The individual has very short limbs, the brevity of the lower extremities conferring upon him a dwarfish stature. The achondroplasic dwarf differs from the phocomelus monster largely because in the latter the affection dates from the embryonal period, while in the former it develops in the course of fetal life.

11. Fetal Traumatisms.—Injuries occurring during fetal life must be distinguished from traumatisms of intra-partum origin, on the one hand, and certain accidents which probably date from the embryonal period, on the other. This is by no means a simple matter. Fetal traumatisms may be divided into wounds of soft parts, fractures, dislocations, and amputations.

Wounds.—Scars and circular defects of the skin have been found at times. When the former occur over what appear to be badly united fractures of the long bones, it is possible that the osseous injury was complicated at the time by a cutaneous wound. The circular defects which are usually encountered on the

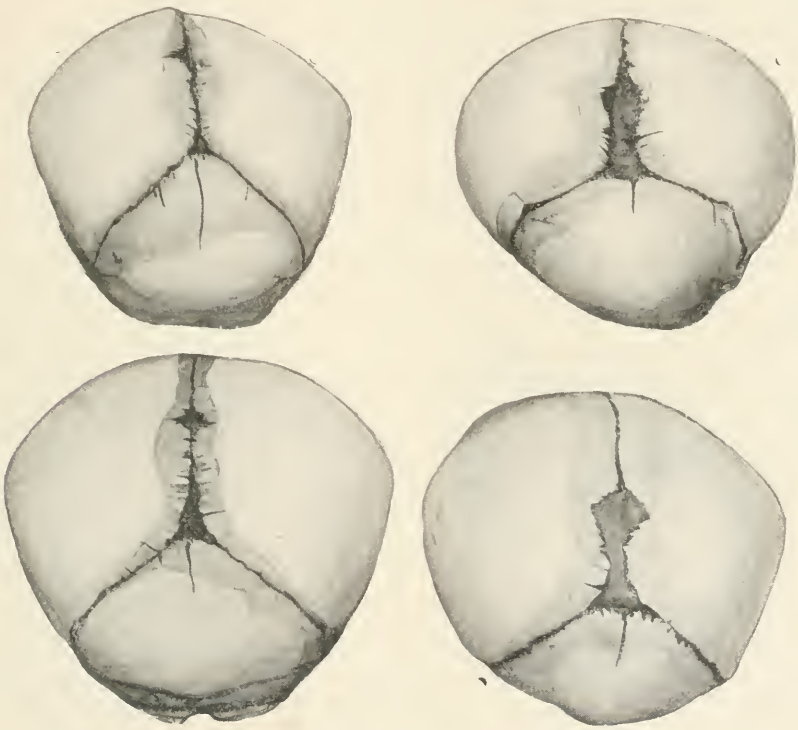


FIG. 439.—FOUR SKULLS SHOWING LACK OF DEVELOPMENT OF THE PARIETAL BONES ("FALSE FONTANELLES") AND CONGENITAL FISSURES OF THE PARIETAL AND OCCIPITAL BONES ("FALSE SUTURES").—(*Author's collection.*)

scalp are due, it is thought, to the tearing away by amniotic adhesions of portions of the integument (see Congenital Defects of the Skin, Section VI).

Fractures.—Clinically we understand by this condition various malformations which indicate more or less imperfect bony union of a past fracture. Thus, observers have noted imitations of all the terminations of fractures in extra-uterine life, such as nodular swellings from excess of callus, angular union, false joint, etc. In some cases scars of the soft parts over the fractures appeared to indicate that the latter had been complicated by a cutaneous wound. As to causes of fetal bone fractures, it is difficult to conceive of their occurrence save in brittle bones (see Fetal Bone Diseases, page 268). We know that fractures occur intra partum under these circumstances (see Fetal Birth Traumatisms, Part IX). It is generally admitted that these results of fetal injuries are very

commonly associated with true malformations, in which case they must be regarded as received during the embryonal period. When it seems clear that the injury occurred during advanced fetal life, we must explain it by a peculiar combination of causes, such as brittleness of bone, scanty amniotic fluid, and excessively strong fetal movements or external violence.

Dislocations.—What has been said of the nature of fetal fractures will hold good for dislocations. Thus, if recent, they suggest an intra-partum origin. If evidently due, as in some congenital dislocations of the hip, to defective development of structures forming the joint, the possibility of a teratological origin must be borne in mind. This conception of dislocations leaves little to be said of their occurrence during fetal life proper. The joint most frequently involved is the hip, while the shoulder is sometimes affected. These affections are probably considered to best advantage under the head of birth traumatisms. (Part IX.)

Amputations.—In the condition known as spontaneous intrauterine or congenital amputation the defect must be of a character to show that a limb once existed, or, in other words, an amputation stump must be present. The amputated limb, more or less macerated, etc., may be found in the amniotic fluid and be expelled with the fetus. The amputation may affect any portion of the extremities, from a single finger to an entire limb. The occasional presence of what appear to be rudimentary digits upon the end of the stump serves to throw added doubt upon the actual nature of these amputations. Until recently these injuries were thought to be due to constriction by amniotic bands, this explanation being found in most text-books on obstetrics. Dermatologists sought to do away with a traumatic element, and regard the amputation as having been caused by a sort of sclerodermatous constriction of the skin itself. Ballantyne is in favor of doing away with all our present views, believing that the mutilation takes place in the embryonal period.

12. Fetal Neoplasms.—Affections of this class are embryonal in origin, and hence to be ranked with anomalies and monstrosities. The fetal tissues may be the seat of cysts, fibromata, chondromata, lymphangiomata, exostoses, rhabdomyomata, sarcomata, etc.

13. General Fetal Œdema.—Anasarca.—This is a total dropsical condition of the fetus, including complete anasarca and effusion into all the serous sacs, the placenta being often œdematous (Fig. 440). This affection is extremely rare. Ballantyne could find but 60 cases recorded in literature. This number, however, does not include cases of dropsical double monsters. There is sufficient evidence in some cases to connect the fetal œdema with developmental anomalies of the fetal circulation, or perhaps with certain visceral inflammations in the fetus. The behavior of the fetus during gestation presents no peculiarities. Diagnosis during labor is likewise difficult. Dystocia after birth of the head might suggest dropsy of the trunk, but delay at this period of labor might be due to many other causes, which would have to be excluded in diagnosis. A fetus has never yet survived the disease.

General Fetal Œdema in Twin Monstrosities.—There are, according to Ballantyne, no cases on record in which both twin fetuses, whether normal or monstrous, were afflicted with general dropsy; and but two cases are known to have existed in which one of the normal twins has thus suffered (Fig. 441).

14. Maternal Traumatisms.—The fetus may be seriously or fatally injured by external violence. This has already been noted in the section on injuries of the fetus due to external violence (page 269).

15. Maternal Uterine Disease Affecting the Fetus.—Chronic metritis and endometritis have been noted as causes of fetal death. Hirst reports two cases

in which non-development of the uterus was apparently the cause of repeated premature deliveries. Prolapse of the gravid uterus may exist. This is not often primary in pregnancy, and if the organ does not rise in the pelvis it will, especially if the pelvis is small, become jammed in by the bony parietes and abortion occur. Anteversion of the pregnant uterus is not often attended with serious symptoms, but retrodisplacement of the gravid uterus is very productive of abortions. The influential causes are metritis and endometritis, hyperemia, and hemorrhage into the decidua which result from the venous stasis caused by the retro-displacement.

16. Fever in the Mother Affecting the Fetus.—This is a common cause of abortion and premature delivery, especially when fever is suddenly developed. Many experiments have been made on animals in order to arrive at the definite effects that high temperature of maternal origin produces in the fetus. Views on the subject have changed to a great degree accordingly. It has been shown in the guinea-pig, for example, that the fetus can endure a much higher temperature than had formerly been supposed. In one case, the animal after attaining a temperature of 111.2° F. (44° C.), lived nine minutes.* Danger to the fetus must be feared only when the maternal temperature rises suddenly or reaches a point over 105° F. (40.5° C.). In the latter case energetic antipyretic measures would be indicated. In case of maternal death, post-mortem Cæsarean section or accouchement forcé would be useless if the patient's temperature had reached 109° F. (43° C.), or if it had risen with great rapidity.

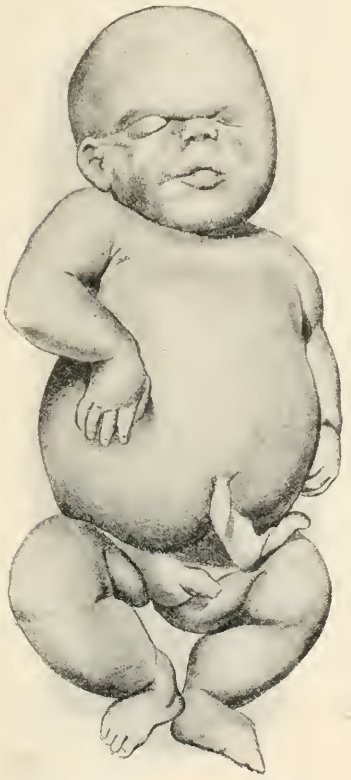


FIG. 440.—GENERAL ŒDEMA OF THE FETUS.—(*Ballantyne.*)

FIG. 441.—GENERAL ŒDEMA IN A TWIN FETUS.—(*Ballantyne.*)

17. Death of the Mother Affecting the Fetus.—The effect of the maternal death upon the fetus *in utero* is considered in the section on post-mortem delivery (Part V).

* Preyer: "Physiologie des Embryo," Leipzig, 1884.

VIII. DEATH OF THE FETUS.

1. Maceration. 2. Mummification. 3. Absorption. 4. Putrefaction. 5. Saponification. 6. Calcification.

Etiology.—Successive pregnancies in the same mother may result in still-births, or in the birth of children who live but a short time. Syphilis in one of the parents is thus suggested, and, according to Ruge, it occurs in 83 per cent. of the cases. Other conditions, however, may produce a like result. Apoplexy of the placenta, membranes, or ovum itself, resulting from an inflammation of these tissues, is a frequent cause of fetal death. Systemic poisoning of the mother with lead, mercury, or tobacco may result fatally to the fetus.

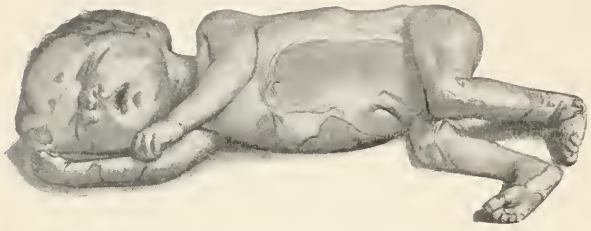


FIG. 442.—MACERATED FETUS.—(*Manhattan Maternity.*)

Not only maternal influences are to be considered in fetal death, but paternal conditions as well, such as old age, extreme youth, alcoholism, chronic disease, etc. Sometimes no apparent cause can be discovered, and the mother seems to abort simply from habit, and at about the same period in her pregnancies. The essential cause of this catastrophe may be in the fetus itself, from diseases, injuries, or deformities. The effect of the death of the fetus on the mother may be really *nil* unless the germs of putrefaction in some way reach the body.

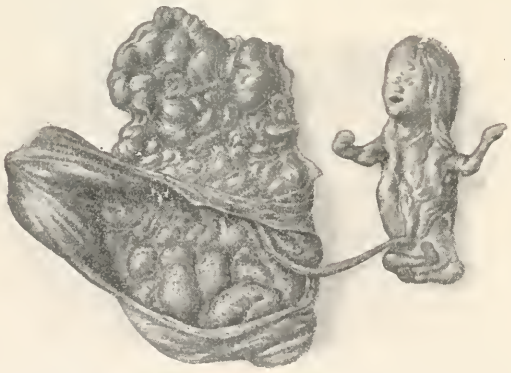


FIG. 443.—MUMMIFIED FETUS AND NECROTIC DECIDUA. The fetus died at the third month, but the entire ovum was retained for seven months more. The decidua and chorion are filled with coagulated hematomata. The fetus measured 3¼ inches (8 cm.), was much deformed, and the left foot was adherent to the right leg.—(*Schaeffer.*)

FIG. 444. — MUMMIFICATION OF THE FETUS.—(*Galabin.*)

Diagnosis of Fetal Death.—(1) The uterus ceases to grow or diminishes in size. (2) Subjective symptoms of pregnancy gradually disappear. (3) The milk secretion appears. (4) The fetal heart-sounds and movements disappear. (5)

There are loss of resiliency and crepitation of the fetal skull. This latter occurs only when the fetus has been dead for some time, and the head has become quite macerated, so that the bones are loosely joined together. (6) Peptonuria and disturbance of renal function occur. (7) Diminution of cervical temperature is noted. (8) There is absence of pulsation in the umbilical cord, or in the fetal precordium, which may be learned by introducing the hand within the uterus. (9) Stoltz's sign is not positive, but is supposed by him to consist in a slight murmur or rustle, which is caused by decomposition of the amniotic fluid. (10) Certain changes in the health or the condition of the mother have been supposed to point to the existence within her uterus of a dead fetus, such as depression of spirits, pallor of the face, a feeling of weight in the lower part of the abdomen; but these signs are uncertain. The health of the mother is not affected, so long as the membranes remain unruptured.

Fig 445.—Fœtus Papyraceus — (*Author's case.*)

Changes in the Fetal Structures.—The kind of change that will take place in the

Fig. 446.—Lithopedion ("Stone Fetus").—(*Ahlfeld.*)

fetus depends on the time of its death, the length of time from that event until expulsion, and whether or not there will be access of air to the amniotic sac. (1) **Maceration** (Fig. 442): This is the most common change in the fetus after death. The skin loses its physiological activity, and, as a result, the vernix caseosa is no longer secreted for the protection of the fetus, and the liquor amnii produces maceration. A fetus in this condition is known as a *fœtus sanguinolentus*. The surface is likened in appearance to a washerwoman's hand, wrinkled and softened. Here and there the epithelium has desquamated, leaving glistening red spots. All of the tissues, even to the internal organs, are, as it were, water-logged. The cord lacks the normal spiral aspect, being round, soft, and smooth. The amniotic fluid, as noted under that heading, is much discolored from the absorption of the

blood coloring-matter and the products of decomposition. It may be reddish, greenish, or brownish, and it may possess an offensive odor. (2) **Mummification** (Figs. 443, 444, 445): This change sometimes occurs after a missed labor. It may be regarded as typical in a dead fetus which has attained the age of several months, but can occur only when the membranes have remained unruptured. If the fetus has for some time been subjected to pressure, as in the case of twins when the live embryo by its growth gradually compresses the dead one, the latter will finally become very flat, and is then known as fœtus papyraceus (Fig. 445). This process of mummification has been rightly named, for such a fetus is dry and shriveled in appearance. The color is grayish-yellow, and the consistency is leathery. The amniotic fluid, which is lacking, has either been absorbed by the chorion or drained off, consequently the fetal appendages are likewise dried and tough, and show some fatty degeneration. This condition is frequently caused by the twisting of the cord around the neck of the fetus. (3) **Absorption:** Total absorption can occur only in the first ten or twelve weeks of pregnancy. It has occurred in intrauterine pregnancy, and is a favorable termination in extrauterine pregnancy. The first step in this process is maceration of the fetus, followed by a complete absorption. The striking characteristic is the thick and mucilaginous condition of the liquor amnii. (4) **Putrefaction:** So long as the membranes remain intact, putrefaction is impossible. Physometra and tympanites uteri may subsequently occur as the result of this transformation. In this process the soft parts are disintegrated, leaving the bones to be disposed of, either by ulcerating their way through the overlying structures, or by surgical removal. It is not uncommon to find suppuration coincident with putrefaction. (5) **Saponification:** Saponification and adipoceration are parts of some chemical change, by which the fetus becomes fatty or soapy, through the deposit within its tissues of margarates of calcium, potassium, cholesterin, and sodium. After this transformation it has a characteristic greasy feel. (6) **Calcification** (Fig. 446): This change may occur as an intrauterine or extrauterine termination of pregnancy, when a lithopedion is formed. The process consists of the deposition of lime salts in the fetal tissues, the result being what is known also as a "stone child." There are recorded cases in which this condition has been shown to exist for years, the petrified fetus being retained *in utero*.

IX. DISEASES OF THE GENITAL ORGANS.

1. Anteflexion and Anteversion. 2. Retroflexion, Retroversion, and Incarceration. 3. Lateroflexion and Lateroversion. 4. Prolapse of the Pregnant Uterus. 5. Torsion. 6. Hernial Protrusion of the Pregnant Uterus. 7. Periuterine Inflammation and Adhesion. 8. Rheumatism of the Uterine Muscle. 9. Metritis. 10. New Growths in the Uterus. 11. Spontaneous Rupture. 12. Malformations. 13. Leucorrhea. 14. Cystic Vaginitis. 15. Specific Vaginitis. 16. Prolapse of the Vagina. 17. Pruritus Vulvæ. 18. Varicosities of Vagina and Vulva. 19. Vegetations. 20. Œdema of the Vulva. 21. Eczema of the Nipple. 22. Mammary Abscess. 23. Hemorrhage from the Genitals during Pregnancy.

1. **Anteflexion and Anteversion** (Fig. 151).—In the later months of pregnancy, owing, in multigravidæ, to the lax condition of the abdominal walls, or to the separation of the recti, or to the giving way of an old cicatrix, anteflexion and anteversion may occur, giving rise to the condition known as pendulous abdomen, or "hanging belly." This condition is also a frequent accompaniment of pelvic deformities, due to the fact that the uterus cannot descend, as in normal pregnancy. The fundus, under such circumstances, may be lower than the cervix.

the latter being carried upward and backward into the hollow of the sacrum; thus labor may be greatly complicated, and the presenting part be directed away from the axis of the pelvic outlet. Incarceration of an anteflexed, pregnant uterus, although rare, has been known to occur, as the result of an inflammatory adhesion, or after the operation of anterior fixation or *suspensio uteri*. In these cases there are usually severe vesical symptoms, and interruption of pregnancy, or the uterus goes to term and operative procedures are necessary to deliver the fetus from the uterus, which has, so to speak, buckled upon itself. (See Maternal Dystocia, Part V.) As a general rule, the uterus replaces itself spontaneously by its own growth. In may be bound down by adhesive bands, resulting from inflammation, in which case pain and difficult micturition supervene. The organ then either forces itself upward into the abdomen or expels its contents. If there are no pelvic tumor, no exudate, and no previous anterior displacement to account for the pathological position, then its cause will probably be found in a contracted pelvis, or in retraction of the utero-sacral ligaments. This condition is also accentuated by the intra-abdominal pressure brought to bear on the posterior uterine wall. In rare cases traumatism may cause acute anterior displacement.

FIG. 447.—ENORMOUS DISTENTION OF THE BLADDER, RECTUM, AND SIGMOID FLEXURE, CAUSING POSTERIOR DISPLACEMENT OF THE UTERUS.

A few believe in the causal relationship of anterior displacements to the pernicious vomiting of pregnancy, but this I have failed to confirm. This malposition often causes sterility, but seldom has any relation to abortion. *Symptoms:* In extreme cases of this condition, shoulder presentations of the fetus must be looked for, and there will be pain in the distended skin, œdema of the lower abdomen, vesical and rectal disorders, while locomotion will often be accomplished with great difficulty. *Treatment:* In the simple and non-adherent cases, which occur in the early months of pregnancy, it will usually be sufficient to regulate the bowels and to keep the patient in the recumbent posture for the greater portion of the time. In case of pendulous abdomen the uterus should be replaced and retained by a moderately firm bandage (Figs. 228 and 229). In the adherent or incarcerated cases an effort should be made, under etherization, with careful manipulation, to break down the bands of adhesion; if this fails and no marked symptoms are present, the case may be allowed to proceed as far toward term as possible. I delivered one child by version at term from such an adherent uterus, the result of anterior fixation for retroflexion.

2. Retroversion and Retroflexion (Figs. 447 to 451).—Retroversion is the

most important of the uterine displacements, on account of the serious results which sometimes follow it. It is a cause of sterility, and if conception does take place, the malposition generally corrects itself by the end of the third or fourth month. At times abortion occurs. In multigravidæ retroflexion is one of the commonest displacements, but it rarely causes sterility.

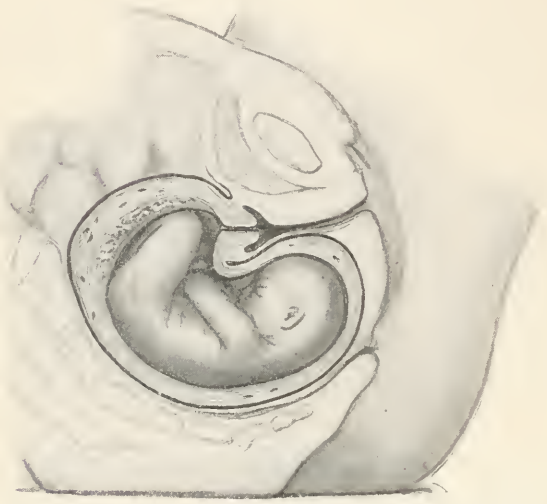


FIG. 448.—RETROFLEXION AND PROLAPSE OF THE PREGNANT UTERUS. Danger of sloughing into the posterior vaginal wall, the anterior rectal wall, or through the perineum.

Etiology.—Backward displacements may be caused by previous uterine disease; *e. g.*, adhesions between the uterus and posterior wall of the pelvis, or by relaxation of the round ligaments. It may also be produced by falls or violent jars; distention of the bladder may be regarded as a predisposing cause. It is more likely to occur in cases of flattened pelvis.

Symptoms.—Vesical irritation from pressure of the cervix upon the bladder, constipation and pain in the back from pressure of the fundus, sensations of pressure and weight in the pelvis, are the prominent symptoms, which generally come on gradually, rarely suddenly. Locomotion is sometimes very difficult; there are frequent reflex phenomena, vomiting holding a prominent place. On examination, the cervix is found elevated, the body of the uterus is in the cul-de-sac of Douglas, the anterior vaginal fornix is empty, and the bladder is displaced downward and backward.

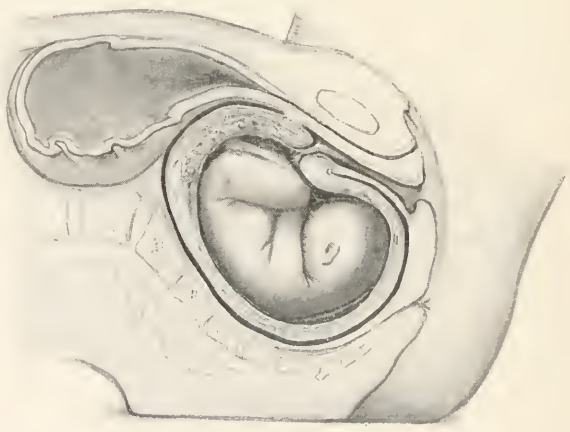


FIG. 449.—SAGITTAL SECTION OF A RETROFLEXED INCARCERATED PREGNANT UTERUS AT FIVE AND A HALF MONTHS. NECROSIS OF THE BLADDER AND DEATH RESULTED.—(*Schwryzer.**)

Terminations.—By the end of the third month, retroversion usually disappears with the upward growth incident to pregnancy, by (1) spontaneous reposition. When this does not occur, however, and when the fundus remains posterior, the increase in size of the uterus causes an aggravation of all the symptoms, and if the upward

* "Arch. f Gyn.," Bd. XLI, Taf. VIII, Fig. 1.

growth and ascent of the uterus are prevented by the promontory of the sacrum, the condition is known as (2) incarceration. (3) Spontaneous abortion or miscarriage is another termination, caused by uterine congestion and interference with the growth of the fetus.

Incarceration (Figs. 449, 450, 451).—By incarceration is meant the retention of the uterus below the promontory of the sacrum and in the true pelvis. If the retroflexed or retroverted uterus is not replaced, or if spontaneous reposition or abortion does not occur, the increasing size of the uterus results in its firm impaction in the pelvis. The symptoms are vesical irritation and pain in the back, retention of urine from pressure upon the bladder and obstinate constipation, or even obstipation, from pressure of the fundus. The genitals and thighs may become swollen and œdematous, and grave symptoms, the result of peritonitis, due to rupture of the bladder or to sloughing of the uterus or to severe metritis or parametritis, may ensue. Abdominal palpation fails to disclose the fundus, while vaginal examination shows that the latter is imprisoned in the cul-de-sac of Douglas. The latter fact may be made plainer by examination per rectum. The cervix may be found behind the symphysis, or it may be difficult or impossible to reach it. There may be great distention of the bladder, and the perineum may even be distended by the pressure of the fundus.

Fig. 450.—Partial Retroflexion. The posterior uterine wall is fixed in the pelvic cavity. The anterior wall dilates and the dotted lines show the progressive dilatation of the anterior uterine wall.—(*Bumm.*)

Diagnosis.—Incarceration, especially in its early stages, may be confounded with extrauterine pregnancy. In the latter condition, however, though the uterus may be somewhat enlarged, the normal relations of the cervix and fundus are still preserved; distention of the bladder does not usually occur, nor is there œdema of the vulva, or perineal distention, or severe symptoms of pelvic congestion. The rupture of the sac in extrauterine pregnancy usually occurs near the end of the second month, while incarceration usually develops during the fourth month. In cases of incarceration uterine contractions may be recognized in the tumor. In doubtful cases examination under anesthesia, with the bladder empty, will be necessary. There is often dribbling of urine at the third or fourth month. Menorrhagia would differentiate this condition from intrauterine polyp. As to the terminations, if the incarceration is not relieved, there may be rupture of the posterior vaginal wall and perineum, with extrusion of the uterus; very rarely pregnancy has continued to term, the anterior wall of the uterus becoming enormously stretched, and the head of the fetus remaining in the hollow of the sacrum. Sloughing of the uterus may occur, with the discharge of its contents into the vagina or rectum.

Prognosis.—In the lesser forms of displacement, occurring early in pregnancy, the prognosis is good, since spontaneous replacement usually occurs. Even in cases of incarceration the prognosis is good if the condition is promptly and properly treated. In neglected cases, however, it is very bad, since the patient

is exposed to many dangers, including rupture of the bladder, sloughing of the uterus, septic peritonitis, shock, and exhaustion.

Treatment.—The bladder and bowels being emptied, in the simpler forms of displacement an effort may be made to replace the uterus by pressure with the fingers while the patient is in the lithotomy position; but reduction will be more easily effected if the patient is in the knee-chest position. (See Operations, Part X.) A repositor may be used if failure attends the attempt with the fingers, and pressure should be made in the upward direction and to one side, in order to avoid the promontory. The reduction will be more easily accomplished if the cervix is at the same time drawn downward by a volsellum forceps (Fig. 463). After replacement, the newly acquired position of the uterus should be maintained by a pessary or tampon, large enough to be efficient. If the uterus is strongly bound down by adhesions, steady and long-continued pressure should be kept up, by thoroughly tamponing the posterior cul-de-sac through a Sims speculum, with the patient in the knee-chest position, the boro-glyceride tampons being renewed daily; if this fails abortion should be induced before incarceration takes place. I have seen the insertion into the vagina of a rubber bag, filled with water and kept in place with a T-bandage, act well in cases not of long standing. This gentle, continuous pressure is very efficacious. After reduction, it will be well to apply a large-sized Hodge pessary. When reposition is once well effected, there is not much danger of a relapse.

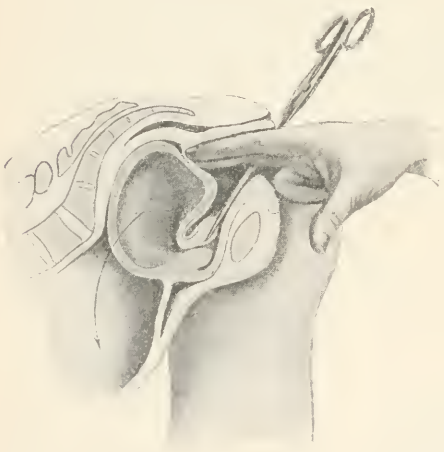


FIG. 451.—REDUCTION OF AN INCARCERATED RETROFLEXED PREGNANT UTERUS BY MEANS OF FUNDAL PRESSURE, TRACTION ON THE CERVIX, AND THE KNEE-CHEST POSTURE.—(*Bumm.*)

Treatment after Incarceration Has Occurred.—Strict asepsis should be observed, and the bowels and bladder emptied. Considerable difficulty may be experienced in passing a catheter, owing to the height of the bladder and the compression of its lower part; a prostatic or gum-elastic catheter should be tried. By drawing down the cervix by a vulsellum forceps, the passage of the catheter will be facilitated. If skilful and careful efforts to pass the catheter are not successful, the bladder must be aspirated with rigid asepsis, about two inches above the symphysis. Efforts at reduction are then instituted under anesthesia, and, if not successful, the induction of abortion will be the last resort. If the cervix cannot be reached by drawing it down with vulsellum forceps, it will be necessary to aspirate the uterus through the posterior vaginal cul-de-sac. The most prominent part should be selected, and as soon as the bulk of the uterus has been sufficiently reduced by the discharge of the liquor amnii, the organ should be replaced, the cervix seized, the os dilated, and the uterus emptied in the usual manner. In rare cases the induction of abortion may be impossible, and vaginal hysterectomy will be necessary, especially if sloughing of the uterus have occurred.

3. **Latero-version and Latero-flexion.**—These are not very frequent, and are usually due to some malformation. A moderate deviation to the right is a normal condition, constituting the right lateral obliquity of the pregnant uterus.

In rare cases the uterus is deviated laterally, owing to a congenital shortening of one of the broad ligaments. Again, there may be a defective development of one side of the uterus, causing latero-flexion. Excessive lateral deviation sometimes occurs in cases of pelvic deformity. (See Pelvic Deformity, Part V.) The effects of these malpositions are more striking in labor than in pregnancy. (See Maternal Dystocia.)

FIG. 452.—TOTAL PROLAPSE OF A RETROFLEXED PREGNANT UTERUS, DUE TO PRESSURE OF A LARGE PEDUNCULATED OVARIAN CYST ON THE LEFT SIDE, COMPLETELY FILLING IN THE TRUE PELVIS, AND REACHING TO THE UMBILICUS. RECTOCELE AND ISCHURIA.—(*Schaeffer.*)

4. Prolapse of the Pregnant Uterus (Fig. 452).—This is an uncommon occurrence, and in most cases the prolapse antedates the conception. It may, however, occur during pregnancy, either as a result of a severe shock or fall, or from a lax condition of the pelvic floor, due to an old laceration of the perineum. It may be caused by retroversion, and it is almost without exception found in multigravidæ. There is probably no case on record in which pregnancy continued till term in a uterus outside the vagina. In the cases reported the condition was probably one of hypertrophic elongation of the infra-

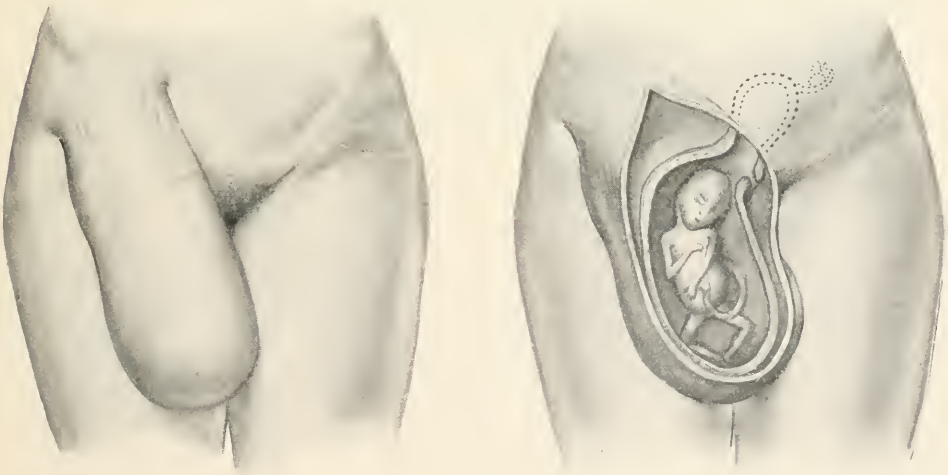


FIG. 453.—LABIAL HERNIA OF THE PREGNANT HORN OF A UTERUS BICORNIS.—(*Winckel-Eisenhart.*)

vaginal portion of the cervix, the fundus of the uterus being in the pelvis. Hypertrophy of the supravaginal or infravaginal portion of the cervix simulates

procidentia, and if amputation of the hypertrophied cervix is performed during the third month, pregnancy may continue without disturbance; in aggravated cases this treatment is indicated. *Terminations:* Spontaneous reduction usually takes place, in consequence of the upward uterine growth incident to pregnancy; in rare cases incarceration may occur, producing pain, pressure symptoms, congestion, and, if not relieved, abortion. *Diagnosis:* It has been confounded with cervical hypertrophy, and this mistake should be avoided, lest it lead to efforts at reposition, which may result in abortion. A careful bimanual examination, with the recognition of the body of the uterus in its normal position, should prevent this mistake. *Treatment:* The bladder and bowels should be watched, and the patient should spend much of her time in the recumbent position with the hips elevated, and standing, walking, and lifting should be avoided. When the prolapse is considerable, the uterus should be replaced and kept in position by

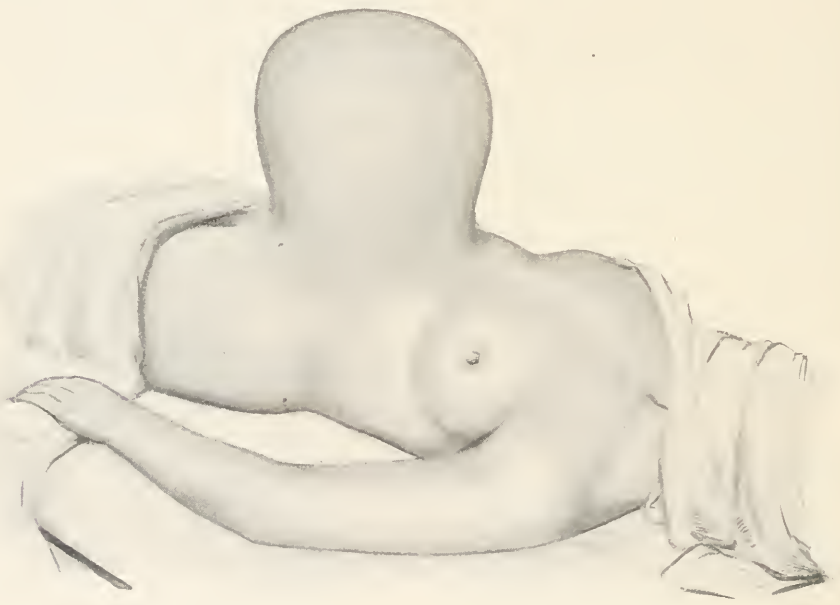


FIG. 454.—HERNIA OF THE PREGNANT UTERUS.—(*Adams.*)

an air or water pessary and a vulvar napkin if required. When incarceration has occurred, the attempt at replacement should be made with the bowels and bladder empty. As a preliminary, the patient should be placed upon the back with the hips elevated, and the congestion of the uterus diminished by scarification. The knee-chest position may be of service, and anesthesia will be necessary. If replacement cannot be effected, the induction of abortion is indicated. After labor prolonged rest should be enjoined, with the hope that involution of the organ may result in cure of the prolapse. There is always a possibility that pregnancy, labor, and the puerperium will be followed by the cure of old displacements.

5. **Torsion.**—In some cases the slight normal twisting of the uterus on its long axis from left to right is much exaggerated, or it may be reversed and the uterus twisted to the left. This condition is usually due to adhesions, the result of inflammatory processes, and in these an ovary being brought forward,

may be injured by attempts to express the placenta or by manipulation. I have never observed a malpresentation or malposition caused by excessive torsion.

6. Hernial Protrusion of the Pregnant Uterus (Figs. 453, 454).—A uterine protrusion may complicate inguinal, umbilical, or ventral hernia, and when it occurs in ventral hernia it is usually due to separation of the recti. It is sometimes seen, however, on the side of the abdomen, and may be due to congenital defects or to an operation cicatrix. Cases of inguinal protrusion sometimes occur, in cases of pregnancy, in one horn of a bicornate uterus. The protrusion of the pregnant uterus in femoral hernia is denied by some writers, but its existence has been asserted by others; *e. g.*, Spiegelberg. Sometimes adhesions between the uterus and intestine cause the former to be drawn into the hernial sac. There may be hernia of the ovary, followed by hernia of the uterus. The *symptoms* in case of the ventral variety are not important, and they are easily mitigated. Not so in the inguinal variety, for then incarceration and strangulation rapidly develop. The prognosis is good in the ventral form, but grave in the inguinal. The *diagnosis* of a ventral hernia will be readily appreciated, and an inguinal or a femoral hernia will present the symptoms of hernia, with the absence of the uterus from its normal position, and deviation of the vagina toward the side on which the hernia is situated. *Treatment:* In the case of a ventral or umbilical hernia the treatment consists in reduction and an abdominal supporter; in the other varieties reduction should be effected if possible, and maintained by a truss, by the recumbent position, and by the avoidance of standing, walking, and heavy lifting. In advanced cases reduction may not be possible, even with herniotomy, and the induction of abortion or hysterectomy may be necessary as a last resort.

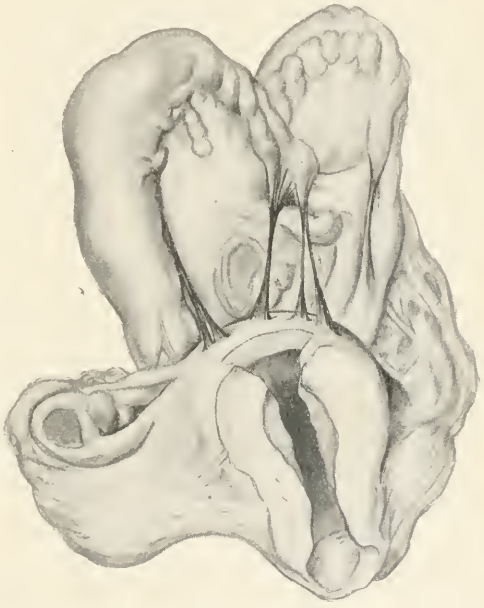


Fig. 455.—Periuterine Inflammation and Adhesion; Tubal Pregnancy; Rupture of the Sac; Internal Hemorrhage; Numerous Cord-like Adhesions between the Uterus, Left Tube, and Intestines.—(*Hofmann.*)

7. Peri-uterine Inflammation and Adhesion.—These affections are often alleviated by appropriate treatment, which should be employed during the intervals between pregnancies (Fig. 455). Sudden rupture of adhesions of the omentum and its contained blood-vessels during the onset of labor may cause fatal hemorrhage into the peritoneal cavity.

8. Rheumatism of the Uterine Muscle.—This is a rare condition. There is pain of a neuralgic or a myalgic character, much aggravated by the intermittent uterine contractions which normally occur during pregnancy. It is observed in patients of the rheumatic diathesis, but may be due to exposure to cold and perhaps to violent coughing or straining efforts. Treatment consists in anodyne local applications, with anodynes and salicylates internally.

9. Metritis.—When this occurs it is usually an aggravation of a previously

existing condition, and thus the symptoms of the pre-existing disease are all intensified by the physiological hypertrophy of pregnancy. It is one of the causes of the pernicious vomiting of pregnancy. Severe pain and the feeling of weight and pressure or "bearing-down feelings" in the pelvis are common; abortion often results. *Treatment:* Boro-glyceride tampons may be used, but if long continued are, of course, likely to induce abortion; anodynes are indicated; extreme danger for the mother, especially from vomiting, may require the induction of abortion.

10. New Growths.—Pregnancy may be complicated by the presence of various neoplasms of the uterus, especially fibroid or fibro-cystic tumors. These do little harm during pregnancy, as a rule, but symptoms of pelvic congestion are marked, often with pain, and their growth is rapid by reason of the increased vascularity of pregnancy. In rare cases operative interference may be necessary, on account of hemorrhage or excessive distention. As a complication in labor, the situation above or below the pelvic outlet, and the mobility of the tumor, will be important factors. Malignant growths have been mentioned in connection with deciduoma malignum; cancer of the cervix has frequently been mistaken for placenta prævia; cystic tumors of the ovary grow very rapidly during pregnancy. New growths are far more important as a complication of labor than of pregnancy. (See Part V.) The most frequent form is the fibroid, which grows rapidly from the increased supply of blood to the genitalia. The cervix is often the seat of small polypoid growths which are the source of severe hemorrhage. Operations for the removal of new growths do not necessarily interfere with pregnancy. (See Operations on Pregnant Women, Part X.)

11. Spontaneous Rupture of the Uterus.—This is a rare complication, when occurring in pregnancy independent of direct traumatism. It may occur from excessive distention; from multiple pregnancy; from hydramnios in a uterine wall already weakened by previous prolonged uterine disease, as endometritis and metritis, malignant disease, a previous hysterectomy, as Cæsarean section, or myomectomy for fibroids. It has occurred in the interstitial variety of ectopic gestation, and I have seen a case of partial spontaneous rupture, following missed labor, in a case of pregnancy in one side of a uterus septus. The symptoms are the same as those of rupture during labor; *e. g.*, concealed hemorrhage and shock. The prognosis could hardly be worse, and the treatment is the same as for a ruptured ectopic sac; hysterectomy probably gives the best prognosis, although suture of the wound may be employed.

12. Malformations of the Genital Organs.—(1) UTERUS.—These are caused, for the most part, by the preservation, to a greater or less extent, of the septa between the ducts of Müller. The student will remember that from the upper portions of these ducts, as they converge, are formed the Fallopian tubes, and that by their juxtaposition and the absorption of their inner walls the uterus and vagina are formed (Fig. 460). If the absorption of the inner walls of the tubes does not take place, the uterus and vagina are divided into two lateral halves. Should a partial union take place, a corresponding degree of malformation results. The organ resulting from this faulty development may present the appearance of one body separated into two parts by a partition, indicating that the two Müllerian ducts have become joined, but that the partition between them has persisted, its absorption not taking place. Or there may be two more or less separate bodies, owing to the non-union of the ducts. There are many degrees of these deformities, each having its own designation, and the arbitrary limits which have been assigned them are numerous. However, the most convenient nomenclature would seem to be as follows: the uterus which retains its original

partition is known as uterus septus duplex. The partition may exist in approximately five degrees. The *first* and slightest degree results in the *uterus incudiformis* (Fig. 142) (anvil-shaped uterus), the organ being flattened from above downward, and its transverse diameter being longer than the longitudinal. Another slight deformity of this variety is the *uterus cordiformis* (arcuate, cordate, or heart-shaped uterus) (Fig. 456); here the original embryonic shape of the uterus is suggested by a depression in the median line of the fundus. This condition is not often discovered during life, although digital examination of the uterine cavity would reveal its existence. In the *second degree* the septum extends the length of the body to the internal os. This form also may escape detection, but may be discovered after an abortion or delivery, and it may even be destroyed by pregnancy. In the *third degree* the septum extends not only through the uterine body, but also through the cervix. This condition could easily be recognized by careful cervical examination. In the *fourth degree* the septum runs down into the vagina, but does not completely divide it. In the *fifth degree* the septum divides the vagina completely, causing the condition known as vagina septa, or double vagina. It will be readily seen that different degrees of persistence of the septum will produce corresponding kinds of malformation. In this bifid condition, as well as in the double uterus, the two sides may be equal or unequal.

Double Uterus (Figs. 457, 460).—In this class the organ is more or less completely divided into two distinct parts. In the first degree the fundus consists of two parts, due to the non-union of the upper parts of Müller's ducts. The external surface of the fundus presents a depression or groove, and the resulting form is called the *uterus bilocularis*, or *uterus bicornis arcuatus*.

Double Uterus Bicornis, Uterus Duplex Bicornis (Fig. 458).—When the ducts fail to unite till they have descended for some distance below the normal point of junction, the uterus bicornis, bicornate or bifid uterus, is produced. There are two diverging uterine cavities, each communicating with the cervix at one extremity, and with a Fallopian tube at the other. The cervix in this form may be single or double. When there are two vaginæ, one of them may have a blind ending above or below.

Uterus Duplex Separatus cum Vagina Separata (Fig. 460).—In the uterus didelphys, or double uterus, we have a rare condition, in which the ducts do not unite at all, and consequently there are two separate uterine cavities and two vaginæ; each body has its tube and ovary. This is a retrograde form corresponding to that of the lowest mammalia. The short broad ligament connects the diverging bodies. The uterus unicornis results from the faulty development of one of Müller's ducts. In a case of this kind one tube and one ovary are generally lacking. There are in this form also varying degrees of development. There may be a rudimentary horn, or it may be sufficiently developed to allow of menstruation, and even of a few months' pregnancy. In cases in which the one horn is entirely lacking, there is sometimes discovered the absence of the kidney and ureter on the malformed side. The uterus unicornis may possess a double cervix, *uterus biforis*.

Absent Uterus.—Diagnosis of this extremely rare condition, even under narcosis, is never positive. Its existence is nearly always coincident with the absence of the entire genital system, pre-eminently the vagina. In searching for the uterus, which is not palpable by the ordinary methods, the rectum and bladder may be explored at the same time, the former by the index-finger and the latter by the catheter. Failure to outline the uterus in this way does not offer positive evidence of its absence, since it may be placed in one side of the

pelvis, or it may be in such a rudimentary condition as to defy discovery. Celiotomy or necropsy alone will prove the presence or absence of the organ.

FIG. 456.—PREGNANT UTERUS ARCUATUS, TRANSVERSE SECTION.—(*Bumm.*)

FIG. 457.—UTERUS BISEPTUS.

Rudimentary Uterus.—The organ may be represented by a transverse bit of connective tissue attached to the bladder, and divided into two parts, to each of which is attached a tiny ovary. The palpation of these organs is rarely possible. In these cases the vagina is

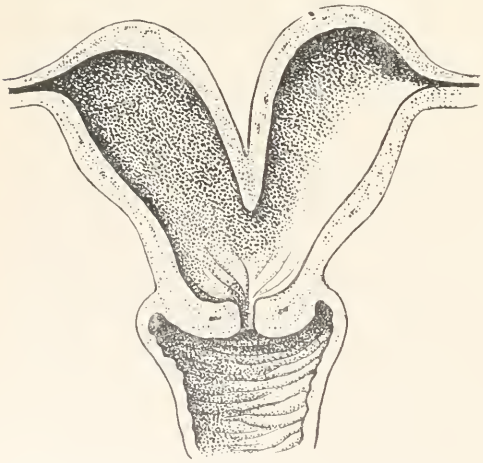


FIG. 458.—BICORNATE OR BIFID UTERUS.

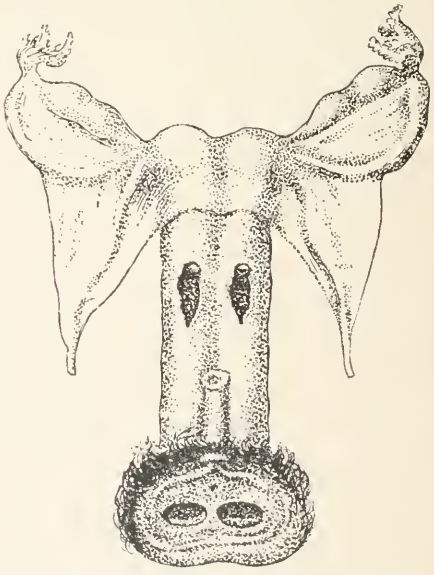


FIG. 459.—UTERUS BIPARTITUS OR DUPLEX.

either absent, or exists in such a stunted condition, with a hymen so very small, that the internal genitalia are often thought to be entirely absent. Some-

times the vagina is represented by a small cul-de-sac which is continuous with

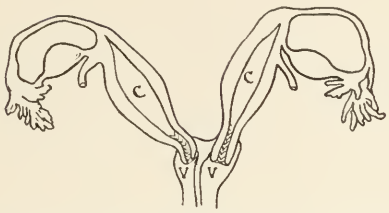


FIG. 460.—UTERUS DIDELPHYS OR DOUBLE UTERUS. *C*, Uterine cavity; *V*, vagina. —(*Dakin.*)

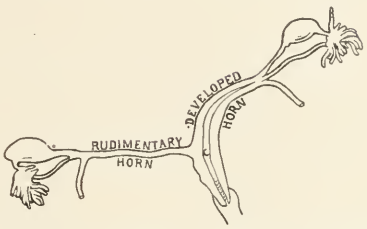


FIG. 461.—UTERUS WITH TWO HORNS, ONE DEVELOPED AND THE OTHER RUDIMENTARY.—(*Dakin.*)

the urethra; although so slightly developed, it may become enlarged on attempted sexual intercourse. Menstruation is rarely present in these cases. When it is, it may be so painful as to indicate castration. Hematometra sometimes occurs. Ovulation may take place without menstruation. Ordinary bimanual palpation, or the method mentioned

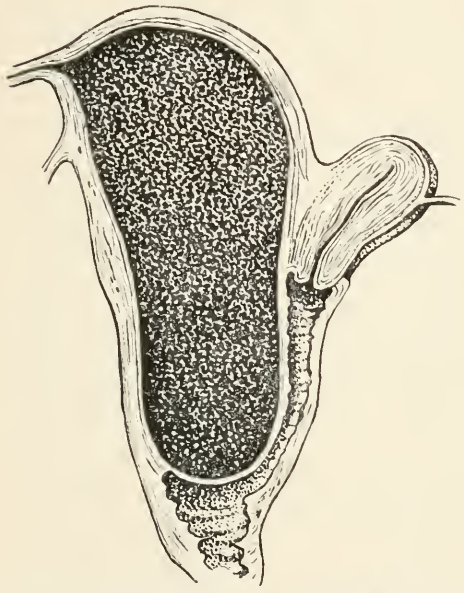


FIG. 462.—ATRESIA OF A RUDIMENTARY HORN OF A DOUBLE UTERUS WITH AN ACCUMULATION OF MENSTRUAL BLOOD.

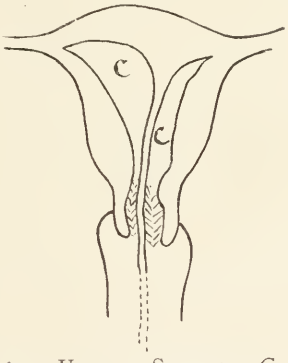


FIG. 463.—UTERUS SEPTUS. *C*, *C*, Uterine cavities.—(*Dakin.*)

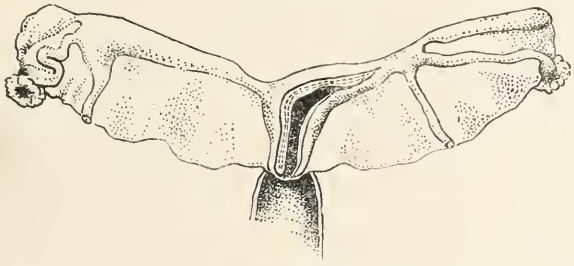


FIG. 464.—UTERUS UNICORNIS.

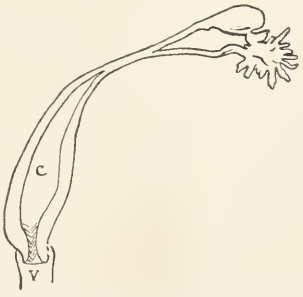


FIG. 465.—UTERUS WITH COMPLETE ABSENCE OF ONE HORN. *C*, Uterine cavity; *V*, vagina.—(*Dakin.*)

under absent uterus, may detect the condition; however, with a well-

developed vagina and established menstruation it may not be recognized. The breasts and pubes are generally well formed. When Müller's ducts are in a very rudimentary state, the ovaries are often in a condition of cystic degeneration.

Fetal and Infantile Uterus; Pubescent Uterus.—Hypoplasia uteri is not an atrophic uterus but results from faulty development. The fetal uterus presents the characteristics of the organ as found in the fetus—a very small, thin-walled, bullet-shaped body, with a cervix several times its length. The vagina is, as a rule, short and narrow. The patient generally suffers from extreme chlorosis, amenorrhea which defies treatment, and attendant troubles. The infantile form presents the normal organ in miniature. The arbor vitæ folds do not reach to the fundus in this form as they do in the fetal form. The patient is troubled with amenorrhea, dysmenorrhea, sterility, and nervous symptoms. Such cases should receive systematic treatment, not only general but also local. The cervix ought to be dilated and the body subjected to intrauterine faradism, as well as medicinal applications. In these cases the vagina, pubes, and mammæ are generally perfectly formed, although the opposite condition may obtain. Menstruation is not often present, nor is sexual desire.

Imperforate fetal uterus is of very rare occurrence. The body especially lacks a cavity. *Uterus fetalis bicornis* is an organ which presents the fetal characteristics in both form and size, and is possessed of the cornua.

Accessory uteri have been noted. In one case a somewhat smaller uterus, in sagittal position, lay in front of the normal organ. The origin of this anomaly is not clear. Precocious development of the uterus, with that of the other genitalia, is not infrequently observed in small children. Unusual cases have been described in which the mucous membrane of the cervix lies in transverse folds. Transverse septa have been found in the cervix. Cases are noted in which these septa had to be removed before labor could be completed. Several congenital anomalies of position of the uterus have been noted. The oblique position of the organ, in which the body is bent to one side or the other by the shortening of one of the lateral ligaments, also occurs.

Congenital retroflexion exists in some cases, as well as anteflexion with its attendant symptoms, dysmenorrhea, nervous disturbances, etc.

Congenital prolapsus uteri is rarely met with, and is generally only one of several associated stigmata of faulty development.

Not alone the uterus is subject to malformations, but the adnexa and external genitalia as well. One or both tubes may be absent or rudimentary. In the former instance the ovaries and uterus are apt to be lacking also. In certain cases there are several openings to the tube which may vary in their position. The tubes may also present abnormalities in length or calibre.

(2) Ovaries.—Absent ovaries constitutes also a very rare condition, which it is impossible to recognize without direct inspection. These organs may be rudimentary, or one alone may be lacking, as in uterus unicornis. The absence may be only apparent, as when the ovary is attached to one of the other abdominal organs. Supernumerary, as well as accessory, ovaries have been reported, the former being far more rare than the latter. Malposition of the ovaries is not very uncommon, and often gives rise to much trouble. In case of the presence of a hernia, the prolapsed ovary may slip into the hernial sac, and cause extreme pain, while the diagnosis of the condition will be very difficult to make.

(3) Ligaments.—The uterine ligaments may be defective or absent. This condition, especially of the round ligament, is generally associated with faulty development of the uterus.

(4) Vagina.—The vagina may be absent or rudimentary. When absent, the

uterus will also generally be absent, or, if present, it will be slightly developed. If only a part of the vagina is present, it will usually be the lower part. At times the whole vulva may be absent or ill-formed. There are all sorts and degrees of deformities of the vagina, associated with a variety of changes of physiological function of the internal genital organs. Indications for operative treatment will depend greatly on the conditions of the whole genital system. Atresia may exist at any place in the genital canal, between the vulval opening and the internal os. It may be congenital or acquired. Congenital atresia is found, as a rule, at the lower end of the vagina. Atresia of the cervix is seldom complete, and is the result of cicatricial formation. This may result from laceration in labor, or rarely there may be a condition of cervical endometritis, followed by agglutination of the lips of the cervix. Complete atresia of the vagina is always associated with malformation of the other genitalia. Atresia of the vulva is not infrequently seen. The vulva may be absent, and this condition is usually only one feature of a general genital deformity. It may also be infantile in its development, as is sometimes seen in feeble women, especially those who have been in wretched health before puberty. The nymphæ may be absent, very small, or hypertrophied.

(5) Clitoris.—Defects in the clitoris are often of great clinical significance. Its absence is a rare condition, but it is not so infrequently hypertrophied, in some cases to such an extent that it is difficult or impossible to differentiate the sex of the individual. It is sometimes rudimentary or even bifid, as when the symphysis is absent, or in exstrophy of the bladder (see Deformities and Monstrosities, page 247).

(6) Hymen.—The hymen may also present deformities. It may be imperforate, or there may be atresia. The supernumerary hymen that has been reported is probably, as a rule, a vaginal bridle. The congenital absence of this membrane is open to grave doubt, although instances of the anomaly have been reported from time to time. In 600 cases of children under sixteen years, examined by the writer for evidences of rape, in no instance was the hymen absent (see Rape, page 29).

Malformations of the urethra and bladder are various. The urethra may be entirely absent, or only partly defective. Atresia urethræ sometimes exists, but generally ends fatally.

Clinical Significance of Deformities.—Malformation of the uterus may affect the course of pregnancy and labor in various ways. In *uterus septus duplex* there are a few cases in which the placenta has been located upon a persisting septum, post-partum hemorrhage occurring from deficient retraction. The empty half of the uterus may of itself become an obstruction to labor, especially if it be hypertrophied and retroverted. During labor it is very apt to sink into the sacral hollow, and contract synchronously with the musculature of the pregnant part. The pregnant side of the uterus turns toward the median line of the body. The clinical significance of this malformed organ is similar to that of the uterus duplex bicornis. In *uterus arcuatus* brow and face presentations are favored when the breech is in that segment of the fundus which corresponds to the back of the fetus. When pregnancy occurs in the anvil-shaped uterus (uterus incudiformis) the fetus is forced to assume the transverse position, on account of the shape of the uterus, which is flattened, having the transverse at its greatest diameter. In the *cordate uterus*, the cavity being only slightly smaller than normal, a two-chambered organ is merely suggested. When the utero-vaginal septum is complete, sexual intercourse may take place in either canal. In labor the septum itself may offer an obstruction. Laceration of the septum often

takes place. In *uterus duplex bicornis* with pregnancy in one horn, the uterine obliquity necessarily present may be a cause of faulty presentation, position, and attitude. When pregnancy occurs in one horn, confusion in the diagnosis with the condition of tubal pregnancy can scarcely be avoided. Menstruation may take place from one horn, while pregnancy exists in the other. Different periods of pregnancy may exist simultaneously in the two horns; labor is sometimes obstructed by the vesico-rectal ligament which connects the two horns in a bicornate uterus. Associated with this malformation are apt to be atony, weak labor pains, and faulty involution. In the *uterus unicornis* with pregnancy in that part of the uterus which has become developed, labor is usually normal. If, however, pregnancy occurs in the rudimentary horn, the course and termination of the case will be similar to that of extrauterine pregnancy (see page 361). The rudimentary horn is not suited for the normal course of gestation, and if this occurs it results in rupture before the sixth month. The danger of this condition is as great as that of tubal pregnancy, from which it cannot be differentiated before operation. In the event of atresia of the stunted horn, hematometra will develop, the diagnosis of which it may be impossible to determine without operation. This may develop into pyometra. When the true nature of this condition is known, it is important to open this retention cyst and allow the contents to flow slowly out, in order to avoid a sudden change of pressure, which might result in the bursting of this thin-walled sac into the abdominal cavity. This would put the patient in great danger of infection and septicemia. Especially is this caution necessary when hematosalpinx exists as a complication. Should the tumor rupture of itself, the tear may be so high up that a part of the sac will be left too far out of reach to be properly drained, and this condition will also be followed by infection and septicemia. In *uterus biforis* (one-horned uterus with double cervix) there may be considerable trouble during labor. If the septum is found, it may be pushed to one side and so kept out of the way, or it may be cut between two lines of sutures. Severe hemorrhage has followed its rupture. It is plain to see how any of the foregoing deformities may cause trouble of various sorts and degrees. There may be trouble with the placenta, as it is not infrequently retained. This may be due to the weak force of expulsion, or to its attachment to both cavities of the uterus. This retention may be the cause of septicemia. When labor is proceeding, the physician may examine the two openings alternately, finding now a dilated os, then a contracted os. Or the wrong side may be examined, and no internal signs of pregnancy be found. In the case of one individual with a double uterus, succeeding pregnancies occurred regularly on the alternate sides.

13. Leucorrhea.—One often observes excessive leucorrhea as the result of the congestion of pregnancy, and following or accompanying acute or chronic inflammation, non-specific in character. Much annoyance is caused by the discharge itself, and the swelling, heat, and general discomfort. The profuse serous discharge becomes later purulent and contains various fungi. In the treatment care should be exercised not to excite uterine contractions. The author is accustomed to rely mainly upon suppositories of hydrochlorate of hydrastis, gr. 1; borate of zinc, gr. ¼; extract of belladonna, gr. ¼; cocoa-butter, or boroglyceride and cocoa-butter, q.s. After careful irrigation of the vagina at bedtime with an alum douche, a teaspoonful of alum to the quart of warm water, care being taken that there is no obstruction to the return flow, and that the douche bag is not more than two feet above the pelvis, one of the above suppositories is inserted into the vagina, and a napkin applied for the night. In the morning the alum douche is repeated. Other combinations in suppositories are useful. When the

uterus is irritable, or the vagina painful or sensitive, suppositories of extract of belladonna gr. ½, and tannic acid gr. 5–10, are used; and the douche is omitted entirely; or a solution of subacetate of lead two teaspoonfuls, and laudanum two teaspoonfuls, to the quart of warm water, is used. Care must be taken during pregnancy in the employment of any form of tampon with the various preparations of boro-glyceride, tannin, zinc, and hydrastis.

14. Cystic Vaginitis.—This is an inflammation of the vagina, usually limited to the upper two-thirds, and accompanied by the development of small cysts, from which, when punctured, air and serum exude; it is attended by a profuse frothy discharge, and the symptoms are more acute than those of simple catarrhal vaginitis. The treatment is the same as for leucorrhea.

15. Specific Vaginitis.—The infection takes place as the result of sexual intercourse, but in rare cases it may possibly be caused by the use of infected towels, or by other contact with infected surfaces. All the symptoms of simple vaginitis are aggravated; there are urethritis and vesical irritation; the discharge is profuse and purulent, and contains the gonococcus (diplococcus of Neisser); smarting pain accompanying urination is especially prominent; abscesses of the vulvo-vaginal gland sometimes occur, and redness and excoriation of the external genitals are common. There is always considerable danger of septic infection during labor, and the fetus is likely to develop specific ophthalmia. *Treatment:* The vagina should be irrigated with an antiseptic solution, sublimate solution (1 : 4000), or permanganate of potash, and excoriated surfaces cauterized with a 2 per cent. solution of nitrate of silver; loose tampons of boro-glyceride and tannin, or of iodoform and tannic acid, may be used; suppositories of iodoform, tannic acid, and cocoa-butter, or hydrastin and boro-glyceride used at bedtime. The introduction of the suppository should be preceded and followed by a warm, carefully administered lysol or creolin douche (1 per cent.). Since the vaginal secretions are alkaline in this affection, Döderlein has suggested the topical application of a 1 per cent. solution of lactic acid to the vaginal walls. Antiseptic vaginal douches during labor are advisable, and after delivery the child's eyes should be washed with a saturated solution of boric acid, and nitrate of silver be instilled into each eye, after the method of Credé (see Part IX).

16. Prolapse of the Vagina.—In multigravidæ, and occasionally in primigravidæ,—in the former from a previously existing condition, and in both as the result of the changes produced by gestation, such as congestion, increased pressure, hypertrophy and loosening of the vaginal walls,—a certain amount of prolapse of the anterior wall, associated with perhaps some cystocele, is common in the later months of pregnancy. Prolapse of the posterior wall with cystocele we not infrequently see in multigravidæ, and occasionally in primigravidæ, from habitual constipation with overloaded rectum and neglect. I once saw a prolapse of the posterior wall with rectocele, in a primigravida, due to persistent constipation, in which the rectocele presented in the ostium vaginæ; I was summoned in the night, the patient mistaking the condition for a possible miscarriage. The *symptoms* are those of vesical and rectal irritation, dysuria, frequent micturition, and perhaps aggravation of existing hemorrhoids; the physical signs are plain on examination. The *treatment* consists in careful attention to the bowels, the avoidance of tight clothing, the manual reposition of the prolapse, and in fitting a proper abdominal support to the patient, to lessen the weight of the uterus (Figs. 228 and 229). The abdominal binder described for use after the puerperium can be employed to advantage, since it supports the lower part of the uterus and the pelvic floor as well (see Part VI). A pneumatic, water, or celluloid pessary may possibly be required, held in place by the above,

or an ordinary T-bandage. During labor prolapse may prove an obstruction (see Part V).

17. Pruritus Vulvæ.—This is always a source of great annoyance, and occasionally of miscarriage. It is due to irritating discharges or to local conditions; it often occurs in diabetes. It may have a reflex origin, as rectal worms, and some have asserted that it is frequently a neurosis. *Treatment:* The general health should be attended to and the cause should be ascertained, and treated if possible; the urine being always carefully examined for sources of irritation, as sugar and uric acid. I have found, after correcting the irritating discharges and attending to the urine and bowels, that sublimate solution (1 : 1000) is of great value in subduing the itching; carbolic acid, either in ointment or solution, is of value; a drachm of carbolic acid to four ounces of ointment of rose, or to eight ounces of water or oil, may be used. Ointments of cocain, ichthyol, resorcin, menthol, opium and belladonna, and salicylic acid are recommended.

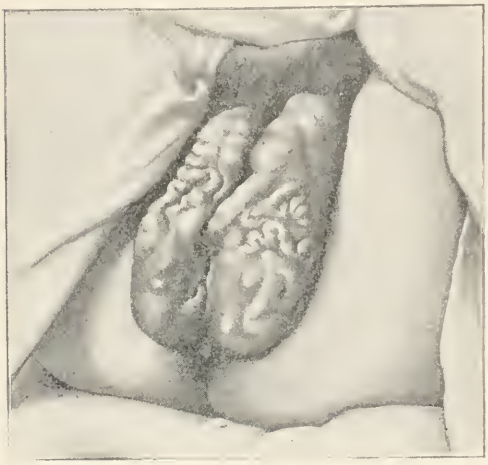


FIG. 466.—VARICOSE VEINS OF THE VULVA. —(*Case of Dr. Wilmer Krusen*)

18. Varicosities (Fig. 466).—Varicose veins about the vulva and lower part of the vagina, the result of the general pelvic congestion, frequently occur. Constipation should be avoided, and in bad cases the vulval region should be supported by a T-bandage, and the patient should spend a good deal of time in the recumbent position. The compound ointment of gall, and ointments of carbolic acid, cocain, and witch-hazel I have found useful.

19. Vegetations.—These often follow gonorrhea, especially when the rules of cleanliness are not observed; they are confined to the vulva. Cleanliness and the frequent application of an astringent powder, as oxide of zinc, or bismuth and salicylic acid, boroglyceride and tannin, will be sufficient for treatment; bad cases may be touched with chromic acid, but operative treatment should be avoided during pregnancy.

FIG. 467.—ŒDEMA OF THE VULVA.

20. Œdema of the Vulva (Fig. 467).—Œdema here may be unilateral or bilateral; it may be due to renal insufficiency, in which case it is always bilateral, or to mechanical pressure of the enlarging uterus and fetus upon the pelvic veins. It may also be due to general anasarca, or to local inflammation, as specific vaginitis. When excessive, ulcerative sloughing of the labia may occur, and labor be obstructed (see Part V). In the treatment the cause

is to be sought out and treated: diuretics for the renal insufficiency; an abdominal support for pressure; proper treatment for local inflammation. Hot fomentations and multiple puncture of the tense skin are palliative; the latter should be avoided when possible, for fear of local infection.

21. Eczema of the Nipple.—This, when occurring during gestation, is apt to be a very obstinate affection. For treatment the general health should receive attention. Locally the parts affected should be kept clean, frequent washing being avoided; antiseptic, astringent, and desiccating applications should be used; powdered oxide of zinc and salicylic acid make a good application. The nipples are to be guarded from irritation and exposure to the air by a protective dressing, which, however, should not press upon them. The condition is apt to resist treatment. I have been most successful with the use of Unna's ointment mull, hydrarg. carbolic. (hydrarg., 20 per cent.; carbolic acid, 5 per cent.), cutting a piece of the plaster to fit accurately over the affected part, and renewing it daily, using only a little sterile vaseline in the removal of the plaster.

22. Mammary Abscess.—This may occur during pregnancy, but is not common. I had in my service at the New York Maternity a case of double mammary abscess at the eighth month of gestation, which was twelve months from the birth of the last child. Both breasts were incised, and drainage was employed without interrupting the pregnancy. It frequently occurs during the puerperium, and is discussed in connection with the pathology of that period (see Part VII).

23. Hemorrhage from the Vagina During Pregnancy.—(See Metrorrhagia of Pregnancy.)

24. Hematoma of the Vulva.—The veins of the vestibular bulbs, lying beneath the mucous membrane of the vestibule on either side, are liable to rupture during pregnancy, giving rise to hematoma of the vulva, and possibly profuse external hemorrhage. The condition is found more frequently during parturition and the puerperium. (See Pathology of Labor and Puerperium.)

X. THE TOXEMIA OF PREGNANCY. AUTOTOXEMIA OF PREGNANCY. HEPATIC INSUFFICIENCY. PREGNANCY LIVER. PRE-ECLAMPTIC STATE.

1. *Toxemia of Pregnancy.* 2. *Nausea and Vomiting.* 3. *Icterus* 4. *Convulsions and Coma.* 5. *Eclampsia.*

1. Toxemia of Pregnancy.—Introduction.—The conception of a special toxemia of pregnancy has grown from small and vague beginnings to a well-developed and harmonious theory which challenges the attention of every medical man. That such a condition exists is no longer a matter of doubt; but the extent to which it prevails will unquestionably be a subject of debate in obstetrics for many years to come.

It is unnecessary to refer in detail to the various discoveries which have culminated in the modern theory of the toxemia of pregnancy, which is sufficiently well established to admit of a statement of the etiology, pathology, symptomatology, clinical varieties, course and termination, diagnosis, prognosis, prophylaxis, and treatment. As far as is known, the subject in question has thus far never been dealt with in this systematic fashion, and I am under obligation to Ewing for filling out certain gaps in my attempts in this direction.

Definition.—The toxemia of pregnancy may be defined as a state of the blood and metabolism, possibly arising from the hepatic insufficiency, to which the pregnant woman is strongly predisposed; expressed most commonly by trivial ailments (petty morbidity of pregnancy), but exceptionally by serious, severe, and even pernicious affections, such as acute yellow atrophy of the liver, pernicious vomiting, eclampsia,—conditions which, while once thought to have nothing in common, are now seen to be closely related.

Pathological Anatomy.—The anatomical alterations chiefly affect the liver, kidneys, and spleen. Exceptionally other organs may be involved, as peripheral nerves, thyroid, etc. The blood state in fatal cases resembles that of severe sepsis. *Liver:* Lesions of this organ are constantly present, but exhibit great irregularity in extent and severity. They are either degenerative or necrotic, the latter succeeding the former. We may encounter extensive areas of degeneration without necrosis, and, conversely, may see necrosis result from isolated foci of degeneration. A certain degree of fatty metamorphosis (steatosis) is said to be the rule in pregnancy; and from these minimal changes there may occur a steady increase in intensity until acute parenchymatous hepatitis is reached, this condition consisting of an acute fatty degeneration, plus a proliferation of the interlobular connective tissue (Fig. 468). In like manner necrosis may develop in foci of fatty degeneration, and may occur in increasing severity until it culminates in acute yellow atrophy of the liver (Fig. 469). Whenever necrosis reaches a certain stage the blood-vessels become involved, and hemorrhages and thrombosis may result (Fig. 469). The most severe lesions of the liver are partly degenerative and partly necrotic; for this reason the size and appearance of the liver in the acute toxemia of pregnancy may vary greatly. In one instance the organ may be the seat of acute parenchymatous hepatitis with no diminution in size, while in another, the necrotic element is so marked that the size may be reduced to a third of the normal. Even in the midst of the extensive destruction, there is evidence of attempted regeneration of biliary canaliculi. Ewing, regarding necrosis of the hepatic cell as almost inseparable from the acute toxemia of pregnancy, gives the following degrees of intensity: Necrosis may be limited to individual isolated cells throughout a lobule; or it may involve the zone of cells between the central vein and the periphery; or, finally, it may involve the entire lobule, save a slight peripheric rim of cells (Figs. 468, 469). *Kidney:* The appearances of the kidney are very irregular. Not only does the specific pregnancy-kidney occur under a variety of forms, but it may be complicated with nephritis, which affection may also occur *de novo*. Although some pathologists deny the existence of a specific kidney of pregnancy, the characteristics laid down by von Leyden appear to demonstrate the existence of a condition *sui generis*. From this point of view the pregnancy-kidney is an acute fatty infiltration of the kidney which does not compromise the integrity of the organ, and which tends to disappear after delivery. In rare instances acute toxemia of pregnancy is found to be associated with an acute parenchymatous nephritis, terminating in atrophy. The connection of such a lesion with the specific kidney of pregnancy is a matter of speculation. *Spleen:* In acute toxemia of pregnancy, associated with hepatitis and necrosis of the liver, the spleen may be similarly involved. The damage thus inflicted upon this organ is held by some to account for the mysterious examples of anemia and leukemia which develop after the puerperium. *Nerves:* Polyneuritis occurs in the gravida to a greater extent than may be explained by chance. In some cases the phrenic nerve has been involved. Korsakoff's psychosis (mania with polyneuritis) has also been seen in the gravida. *Thyroid:* The normal enlargement of this organ

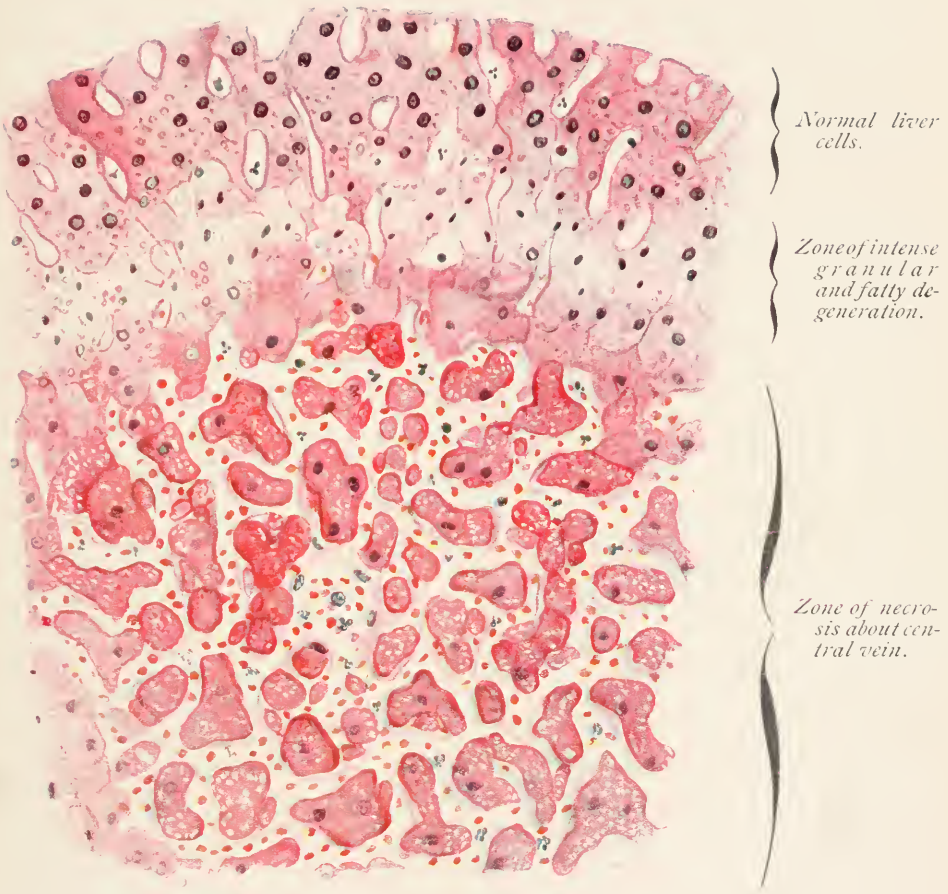


FIG. 468.—TOXEMIA OF PREGNANCY. Portion of an hepatic lobule from a case of the toxemia of pregnancy. Specimen shows intense granular and fatty degeneration, and also zone of necrosis about the central vein. ×75 diameters.—*(From a specimen in the Pathological Laboratory of the Cornell University Medical College.)*

in the gravida has been found wanting in certain cases of eclampsia. *Blood:* In high degrees of toxemia of pregnancy the blood shows characteristic changes which resemble those of sepsis. Thrombosis and embolism may occur, beginning in the hepatic veins. Another feature of this state is the acute hemorrhagic diathesis, which leads to surface hemorrhages (petechiæ or extravasations). Finally icterus may be enumerated among the symptoms of the acute dyscrasia of the blood.

Etiology.—There are three sets of etiological factors which must be considered in connection with the toxemia of pregnancy: 1. Conditions which predispose to hepatic insufficiency, comprising pregnancy itself, heredity and a previous history of toxemia. 2. Accessory factors which tend to modify the disease and cause it to assume special clinical types, and to influence the time of its appearance; these comprising nervous instability, the menstrual epoch, and mechanical factors. 3. Actual toxic substances in the blood, or toxic states of that fluid. The exact relation of this class of factors to the hepatic insufficiency is problematical, because a vicious circle is involved. Thus a toxic blood-state may by throwing additional work upon the liver cause a partial paralysis of its functions, which in turn causes the accumulation of more toxic matter in the blood. Each individual factor will now receive separate discussion.

1. *Pregnancy.*—This is the *sine qua non* among etiological factors; for while many of the phenomena of the toxemia of pregnancy may occur in the non-pregnant, some of the lesions of the liver and kidney appear to occur only in gravidity, while clinically the course of the malady is intimately bound up with gestation. The frequent—yet by no means universal—cessation or great amelioration of the symptoms after death of the fetus or emptying of the uterus is alone sufficient evidence of the specificity of this affection. The relationship of pregnancy to the autotoxic state is considered more fully under pathogeny. *Hereditary, Congenital and Acquired Tendency to Hepatic Insufficiency:* For the great influence of heredity in this connection see page 298. We may also infer that hepatic insufficiency may be acquired in various ways. *Previous History of Toxemia of Pregnancy:* In a large proportion of cases one attack appears to predispose to another at a consecutive pregnancy. This is especially likely to happen if the first attack was of sufficient severity to produce structural alterations of the viscera. Even in the absence of a history of toxemia, the mere fact that children of a given woman are born in rapid succession may furnish a very strong predisposition; for the toxemia, however slight or latent, may become *cumulative.* If the toxemic symptoms are not resolved after delivery and persist into the lactation period, conception would likely be followed by toxemia in an aggravated form. In this connection we may cite the statement by Ewing that in some cases of dysmenorrhea antedating conception the women exhibit evidences of a toxic condition resulting apparently from suppression of the menses. A woman of this sort is notably predisposed to toxemia in case of conception.

2. *Accessory Factors.*—Numerous factors help to shape the course of the toxemia. The *nervous instability* which, according to von Herff, is almost inseparable from pregnancy, and which perhaps is itself evidence of an autotoxic state, undoubtedly plays a very prominent rôle—in proportion to its degree—in the causation of paroxysms of vomiting and eclamptic convulsions. If reflex irritation is the factor in the morbidity of pregnancy which many assume, it can be such only through the accession of nervous instability. An important factor for determining the onset and exacerbation of symptoms is the *time of*

the menses. Thus hyperemesis may first set in or become much aggravated or develop terminal symptoms, at the end of the various months of pregnancy. When the increase of the ovum and uterus is of such extent as to raise the intra-abdominal pressure, compress important organs, and interfere with circulation and respiration, this *mechanical factor* often becomes of great significance in the development of pregnancy-kidney, and other conditions—constipation, for example—which may increase the severity of the autotoxic state.

3. *Toxic Substances and Influences.*—(1) *Nitrogenous substances* derived either from katabolic activity or from the ingesta are most commonly suspected of participating in the toxemia of pregnancy. The failure of the liver to synthetize the lower nitrogenous products of katabolism to urea and uric acid is held to be responsible for the accumulation of these substances in the blood. There are included here amino-acids, ammonia, xanthin bases, etc. However, but one of these—carbaminic acid—is a known chemical poison; and this has not yet been found in the blood in toxic quantities. If the toxic state already exists, a nitrogenous diet appears to favor greatly the development of convulsions; this fact arguing that the *peptones* and *peptoids* of digestion normally require disintoxication by the liver before they are fit for assimilation. Finally, nitrogenous products of putrefaction, ordinarily rendered harmless by the liver, may be pathogenic in the gravida. (2) *Bile:* From the frequent use of the term cholemia as a synonym for toxemia of pregnancy, it might be thought that the condition represents an absorption or suppression of the bile. This is not the case, however. Bile when injected into animals possesses narcotic properties, but there is not much evidence that bile *per se* or the substances from which it is produced plays any important rôle in the genesis of the autotoxic state of the gravida. At the same time it is by no means impossible that such is the case. The subject is considered more fully under pathogeny. (3) *Changes in the normal alkalescence or concentration of the blood* may be responsible for the toxic phenomena. Thus the same diminution of the alkalescence which is known to exist in diabetic coma (so-called acid-intoxication) may be noted in the acute toxemia of pregnancy. This is held to be due to the presence of "acetone bodies" (acetone, aceto-acetic acid), of lactic acid and the higher fatty acids, and probably represents imperfect oxidation of carbohydrates. In this condition the urine gives an intense acid reaction. The opposite state of increased alkalescence is seen under experimental conditions (Eck's fistula) and perhaps clinically as well—as in cases in which the breath, urine, etc., are ammoniacal. (4) *Occasional or Chance Poisons:* Since the liver of the gravida is in a state of exhaustion, it is well to bear in mind that it may not be able to fix and neutralize ordinary poisons of alien source which have a special tendency to injure it. These comprise phosphorus, arsenic and antimony, alcohol when taken habitually, and perhaps other substances of a similar nature. Bacterial toxins must also be borne in mind as chance factors.

Pathogeny.—Pregnancy itself is doubtless the efficient cause of the hepatic overwork, for the liver presides over anabolism and must be largely concerned in the upbuilding of the fetus. The importance of the hepatic tissue to the growing organism is best seen in the disproportionally large size of the liver in the fetus and infant. It is often stated that the maternal liver should not be overtaxed in the early months of pregnancy; and this may be true in the sense that the products of embryonal katabolism must be insignificant; we must bear in mind, however, that during the embryonal period a rapid organogenesis occurs; and that the various tissues and organs are all rapidly evolved from a relatively undifferentiated matrix. It is commonly affirmed that this rapid

Peripheral row of intact cells.
Narrow zone of very fatty cells.
Edge of area of necrotic and disintegrated cells, which occupy inner two-thirds of lobule.

FIG. 469.—TOXEMIA OF PREGNANCY. Portion of an hepatic lobule from a case of pernicious vomiting of pregnancy. Specimen shows fatty degeneration and necrosis.—*(From a specimen in the Pathological Laboratory of the Cornell University Medical College.)*

differentiation is accomplished by the aid of enzyme-like bodies, which are generated, do their work, and give way to others. While it is often said that the maternal blood contains all these potentialities for fetal development, it would be more nearly correct to state that this responsibility is invested in the chief hematopoietic organ—the liver.

To this drain upon the liver must be added the influence of suppressed menstruation in the gravida, which is said to entail congestion of the liver, and perhaps also retention of toxic substances in the circulation. If, now, the various predisposing causes are borne in mind, as heredity, previous toxemia of pregnancy, etc., we may readily conceive of causal factors which may explain the "failure of the liver" even when it occurs, as in rare cases, early in pregnancy.

As pregnancy advances the risk increases. Thus the gravida after subsidence of preliminary nausea, etc., may develop a voracious appetite, and may take large quantities of nitrogenous food. The steady growth of the uterus and ovum must add in time to the katabolic work of the liver. The increase of intra-abdominal pressure must be prejudicial to the work of that organ; and the obstinate locking-up of the bowels which frequently occurs must favor the absorption of putrefactive products. The woman cannot exercise, and her respiratory activity is prejudiced. To all these contingencies must be added the possibility of some bacterial infection, an addiction to alcohol, or some form of drug-poisoning, as from arsenical wall-paper, "complexion wafers," etc.

Toxemia in pregnancy has been noted in connection with ectopic gestation and even with hydatidiform mole. The latter fact appears to disprove the likelihood of a fetal source of toxemia.

Symptomatology.—Some of the more important and constant symptoms require special attention. These may be grouped under the following heads: viz., gastro-hepatic, urinary, nervous, and cutaneous. *Gastro-hepatic:* While by no means constant, pain and tenderness over the epigastrium and right hypochondrium are not infrequent. The area of hepatic dulness may be increased. This class of symptoms may be due to a variety of causes—hepatic congestion, perihepatitis, soreness of muscles from vomiting, and in some cases actual inflammation of the liver. *Urinary:* In high degrees of toxemia unsynthetized nitrogen compounds appear in the urine at the expense of the urea (ammonia compounds, amino-acids, purin bodies). In some cases leucin may be present as a result of destruction of liver tissue. Generally speaking, the urinary findings in the toxemia of pregnancy are sufficiently numerous and varied to discourage classification. They tend to show that various phases of hepatic insufficiency may occur irrespective of other changes. *Nervous:* This class of symptoms is characteristic of the toxic state. Alteration of character may be of the same nature as the moody, peevish, and irascible "spells" which result from bilious crises. An increase in reflex excitability may account for some of the morbidity of the gravida. In higher types of toxemia an increase of cortical activity is shown by intense restlessness, agitation, insomnia, convulsions, delirium, etc. This class of symptoms may be followed or replaced by the opposite group—apathy, hebetude, somnolence, stupor and coma. Headache may be mentioned in this connection. In some cases the nerves are directly attacked by a circulating poison (polyneuritis). *Cutaneous:* Several cutaneous symptoms of presumably toxic origin—pigmentation, pruritus, etc.—are discussed in the section on Skin Diseases in Pregnancy (page 337). The relationship of the pernicious *impetigo herpetiformis* to the toxemia of pregnancy has not been determined. Ewing regards it as belonging here. Although heretofore looked upon as a septic condition with metastases to the skin,—death occurring usually from

pneumonic deposits,—the prominence of vomiting as a symptom is worthy of mention, as suggestive of the autotoxic state. *Jaundice* in the gravida is a subject of unusual interest. Despite the frequency of hepatic insufficiency in the gravida, icterus appears to be quite rare, and when present due in some cases to mere coincidence, as simple obstruction, etc.

Clinical Types.—The clinical picture of the toxemia of pregnancy varies greatly with the intensity of the intoxication; but whatever its degree, it resembles markedly the various symptoms of hepatic insufficiency in the non-pregnant. The *mild*, self-limited form, comprising the so-called petty morbidity of the first half of pregnancy, as seen especially in primigravidæ, agrees in a measure with so-called "biliousness" or "hepatism." The gastro-intestinal symptoms comprise nausea, vomiting, various forms of indigestion, anorexia, constipation, etc.; the nervous and cerebral symptoms comprise nervous irritability, apathy, depression, alterations of character, hysteria, headache, vertigo, etc. Chloasma and pruritus are common.

The highest or most intense degree, constituting the so-called *acute* (including *fulminant*) toxemia of pregnancy, agrees closely with the profound toxemia which accompanies acute parenchymatous hepatitis and acute yellow or red atrophy of the liver. Vomiting is severe and incessant, and "black vomit" is often present. The cerebrum is profoundly affected. Intense headache occurs. At the outset we usually find increased motor activity manifested by restlessness, anxiety, insomnia, which symptoms pass readily into delirium, maniacal excitement, and convulsions. This stage of excitation passes in turn into somnolence, stupor, and coma. In exceptionally severe cases there is no stage of excitement, the patient developing stupor and coma at the outset. Excitation and depression appear to alternate in some cases. In acute toxemia the urine almost always shows evidence of greatly disturbed metabolism, nitrogen retention, albuminuria, presence of leucin and tyrosin, etc., etc., and often of actual renal lesions. The patient nearly always succumbs, and quickly—usually in a few days, and often within forty-eight hours or even less.

Between the acute and mild forms we find every degree of intensity. The so-called *pre-eclamptic state* represents a severe but not necessarily pernicious form of toxemia, which very often yields to timely treatment. Similar states occur early in pregnancy and without any connection with eclampsia, and while alarming, may still respond to treatment. A moderately severe toxemia appears prone to attack some one group of organs and set up a peculiar train of symptoms. Hence we encounter such well-marked clinical syndromes as pernicious vomiting, eclampsia, psychoses, polyneuritis, etc., all of which are considered by themselves.

Course, Termination, and Sequelæ.—The acute toxemia is probably invariably fatal, although recovery seems to have occurred from analogous conditions in the non-pregnant. While it tends to destroy the patient rapidly, it has been known exceptionally to persist for months. Death usually occurs within a week after the supervention of the nervous stage, and may result in a few days or even hours.

Fetal death or emptying the uterus appears to exert no salutary effect; nor is the condition amenable to disintoxicating methods, or to any treatment whatever. Persistence through and beyond the puerperal state could only occur as a rare exception, death being none the less inevitable.

The course and termination of subacute toxemia are discussed under Nausea and Vomiting of Pregnancy, Polyneuritis and Eclampsia.

Mild or benign toxic symptoms often cease spontaneously in the course of

pregnancy itself, and in any case they usually disappear after delivery. Ewing states that in some cases hepatic insufficiency persists after delivery. The commonest actual sequelæ consist of blood changes; paralysis following neuritis; and occasional nephritis developed from pregnancy-kidney. Ewing believes that puerperal sepsis may often be practically a sequela of the toxemia of pregnancy, through furnishing a strong predisposition to infection.

Diagnosis.—Here are comprised the recognition of the various degrees of hepatic insufficiency, beginning with the mild or benign types and ending with complete paralysis; the recognition of the various associated blood-states; and, finally, the characterization of the particular clinical type. It is therefore requisite in all suspected cases to make a physical examination of the liver and spleen, and to have the urine analyzed by an expert, with special reference to the detection of unsynthetized nitrogenous bodies, and organic acids. The patient may be tested on alimentary glycosuria. It is, of course, highly important to measure the work of the kidneys. In theory, a blood examination should be valuable, but the simpler tests would not yield much information, while a quantitative or physico-chemical analysis would not be possible in routine work. The nervous system should be examined, because the degree of nervous instability is a factor of importance, and the disposition of the toxemia to attack the higher nerve-centers must be borne in mind. Further, it is important to recognize the evidence of a hysterical element when this is present; also mechanical factors and chance complications.

Whenever a pregnant woman is taken violently ill, we must always bear in mind the possibility of a fulminant type of the toxemia of pregnancy. It is here that the condition is usually misunderstood; and mysterious cases of sudden death, alleged suicides or accidental poisonings, supposed instances of acute meningitis or of fulminant infectious disease, may perhaps have been examples of the most intense degree of toxemia of pregnancy. To make an exact diagnosis in these cases may not be possible.

In an ordinary case of the acute type a diagnosis should be made from a physical examination of the liver, and the results of the urinary analyses, together with the rational signs.

In the rare cases in which the liver appears normal or the urinary examination is negative the diagnosis is of course difficult. In these anomalous cases the patient may appear to suffer from some profound infection or intracranial disease.

The diagnosis of the subacute types of toxemia will be considered under Hyperemesis, Eclampsia, Polyneuritis, etc.

Recognition of the milder degrees of toxemia demands no special consideration. Whenever a woman vomits persistently her urine should be examined for evidences of faulty metabolism, as shown by the percentages of total nitrogen excreted as urea nitrogen, ammonia nitrogen, kreatinin nitrogen, uric acid nitrogen, and undetermined nitrogen. A toxemic state is often first indicated by departures from the normal standard, as high ammonia nitrogen percentage or undetermined nitrogen percentage of the total nitrogen.

Mere diminution of the percentage of urea does not signify nitrogenous retention, for the total nitrogen is distributed among the urea, ammonia, kreatinin, uric acid, amino-acid, etc.; and while under normal conditions over 80 per cent. of the nitrogen occurs in the form of urea, certain urines often contain very large percentages of ammonia-nitrogen and correspondingly low ones of urea. Diet and elimination of nitrogen by the bowel must always be considered in this connection. Increased percentage of ammonia-nitrogen is not pathognomonic of toxemia of pregnancy, but may be viewed with suspicion.

My experience embraces 62 urinalyses for the nitrogen partition in 24 patients, and does not permit me to formulate rules for a guide to the diagnosis of an impending or existing pregnancy toxemia. However, in most of my cases examined, faulty metabolism, as determined from urinalyses of twenty-four hour specimens of urine for total nitrogen and its coefficients, coexisted with clinical symptoms of toxemia.

Prognosis.—This is good in the benign forms of toxemia. In the acute and fulminant types the prognosis is nearly hopeless, since the mortality has been almost universal. For the prognosis of eclampsia, hyperemesis, etc., see subsequent sections. Richard C. Norris* is inclined to regard some cases of sudden death in the puerperium as due to cardiac failure induced by the direct action of the autotoxic blood-state upon the cardio-vascular system.

Treatment.—As for *prophylaxis*, a woman who seems to suffer much constitutional reaction during menstruation should be carefully watched during gestation. Charcot states that a functionally incompetent liver is very likely to be inherited; therefore a woman whose ancestors and kindred show a marked tendency to "hepatism" would run more risk in becoming pregnant than one without this ancestry. Finally, a woman in whom symptoms of toxemia appear to persist during the period of lactation should by all means avoid a second conception until complete recovery has occurred. For other resources read section on Etiology.

The *curative treatment* demands a careful study of the symptoms in all cases, and prompt action in most. Mild toxemia, so called, requires only expectant management.

Despite the apparently hopeless outlook in acute toxemia, I strongly recommend in all cases the same general line of treatment as that I set down for the Preventive Treatment of Eclampsia. (See pages 308 and 309.) In addition to the exclusive milk diet, and the stimulation of the action of the liver, bowels, kidneys, skin, and lungs, I have found repeated colonic irrigation and infusion, and intravenous infusion of the decinormal saline fluid, valuable. On account of the diminished alkalescence of the blood, alkalies are indicated in theory, as they are in diabetic coma, in which state they have produced some benefit. Bearing in mind that the hepatic lesion may in a given case be due in part to a bacillus, methylene-blue, which is eliminated by the bile, should be of value as an antiseptic.

My views upon the evacuation of the uterine contents are the same here as in the Preventive Treatment of Eclampsia.

Conclusion.—It will be asked, no doubt, "Why devote so much space in a text-book to a condition like the acute toxemia of pregnancy, which apparently is rare, and can seldom be foreseen, and, thus far, has almost resisted treatment?" My answer is, that it represents a phase of our knowledge which is in its infancy, and a subject which will, in my belief, come in time to throw light on many dark places in obstetrics. Acute toxemia of pregnancy is not as rare by any means as is generally believed, and is a most insidious affection when it does occur, masking itself, as it does, under various clinical pictures.

If unrecognized, it may lead to a suspicion of poisoning, suicide, or some other type of preventable death. We might, in a general way, compare the recognition of this state with the discovery of ptomaines and ptomaine poisoning, in regard to practical significance. Again, it may some time be possible to foresee, prevent, and cure this condition when not of the fulminant type. Recovery

* "Effects of the Toxemia of Pregnancy upon the Cardio-vascular System," "Amer. Jour. Obstet.," July, 1903, pp. 31, 104

is not uncommon after acute phosphorus-poisoning, thereby showing the regenerative power of the liver.

2. Nausea and Vomiting in the Pregnant Woman.—This subject is considered under the toxemia of pregnancy largely because in fatal cases hepatic lesions of the same character as those which occur in eclampsia and acute yellow atrophy of the liver may usually be found; also because severe vomiting is a prominent symptom of many toxemias. If vomiting in the pregnant is frequently spoken of as hysterical in character, it must be borne in mind that this refers only to the clinical expression of the condition.

(1) Simple (So-called Physiological) Vomiting.—Slight nausea, with or without vomiting, occurs in about one-half of all pregnancies, and in the vast majority of primiparæ; the symptom appears about the end of the first month, and is usually associated with perversions of taste. There may be general anorexia, repugnance to certain articles of diet, and unnatural cravings for others not usually appetizing. Considered in their totality, symptoms referable to the digestive tract are almost universally present in pregnancy; those who escape nausea or perversions of taste and anorexia may suffer from hyperorexia or bulimia. These symptoms usually persist until the middle of the fifth month, when they subside spontaneously, and appetite and normal tastes return.

In their simplest expression the nausea and vomiting of pregnancy bear a notable resemblance to the morning-vomiting of the alcoholic subject, appearing as a rule upon rising from the recumbent position. Retching may be the only active symptom, or actual vomiting of mucus, gastric juice, or biliary matter may occur. The woman is usually able to eat breakfast, and has no further gastric disturbance during the day. In rare instances the nausea and vomiting occur in the latter part of the day or during the night. In the next higher degree the woman vomits during or after the meal. She is, however, usually able to continue eating and to retain the food; so that there is no real interference with nutrition.

In a still higher degree nausea is more than a momentary affair, and persists for several hours, often accompanied by ptyalism and distress in the epigastric region; vomiting is then slow to occur, and is much more distressing than usual. In all degrees up to this point there is no necessary interference with nutrition, and no absolute refractoriness to treatment.

(2) Hyperemesis.—When vomiting is sufficiently persistent or distressing to demand active treatment, the term hyperemesis is employed to distinguish it. In a woman suffering from this degree of vomiting there is a tendency to aggravation of the symptoms and interference with nutrition.

Vomiting of pregnancy sometimes pursues an anomalous course, without regard to its severity. Thus, it may begin immediately after conception, as if it were an expression of suppressed menstruation. The ordinary appearance of vomiting coincides with the period of the second (suppressed) menstrual period. The usual time of cessation of vomiting corresponds to "quickening" of the fetus. In a few cases the disappearance of vomiting may be succeeded by diarrhea. It has also been noted that a strong mental impression about this time will cause the sudden cessation of vomiting. In a small proportion of cases the latter symptom is prolonged to term, and in another series of cases the gastric disturbances set in about the middle of pregnancy. This relation to suppressed menstruation, with the occasional resemblance to the morning vomiting of alcoholic subjects, suggests the presence of a toxic element, even in so-called physiological and benign degrees of vomiting; as does also the

coexistence of numerous symptoms mentioned under Mild Toxemia of Pregnancy. (See page 296.)

Most standard authorities, including gastro-intestinal specialists, continue to refer benign vomiting of pregnancy to uterine irritation, due to compression of the uterine nerves by the growing uterus in general, added to abnormal uterine distention, malpositions, cervicitis, etc., in particular. Reflex vomiting sometimes occurs in pelvic affections of the non-pregnant. But it is generally admitted that an increased nervous excitability furnishes a predisposition; and we must not forget that this exalted sensibility, wherever found, is itself attributed by many to an autotoxic state of the same nature as that which is produced by nervous exhaustion. Quite recently Dr. M. Knapp, of New York, has denied the existence of reflex vomiting.

Treatment.—Benign vomiting may be relieved by simple measures, such as breakfast in bed before assuming the erect posture; the use of concentrated liquid food; anesthesia of the stomach by a few drops of laudanum; readily digestible solid food; sparkling wines, or alkaline effervescent waters; aromatics; cracked ice, etc. After eating, recumbency should be maintained. Recent clinical experience has caused me to look with suspicion upon even benign vomiting, as the expression of a mild toxemia of pregnancy, and to treat it accordingly, namely, by a restricted diet; stimulating the action of the liver, bowels, skin, and lungs, and by colonic irrigation and infusion.

(3) Incoercible or Pernicious Vomiting.—These terms are applied respectively to vomiting which is rebellious to all treatment, and that which is in any way a menace to life or which has a grave prognostic significance. Several entirely different conditions may be included here. Thus, in the gravida, as in the non-gravida, vomiting may be purely symptomatic in character, although doubtless aggravated and given a peculiar character through the gravid state, which predisposes the woman to nausea and vomiting. Thus, these symptoms may be due to intercurrent gastritis and other severe organic diseases of the stomach; the passage of gall-stones, intestinal obstruction, peritonitis, meningitis, etc., etc. Symptomatic vomiting will be referred to again under "Diagnosis."

Essential vomiting of pregnancy is of two distinct types:

(*a*) *Autotoxic Type* is a manifestation of the toxemia of pregnancy and is accompanied by other severe symptoms of that condition, chiefly headache motor cortical excitement (agitation, restlessness, insomnia, convulsions, delirium), or apathy, stupor, and coma. Vomiting in this condition is violent, incessant, and characterized in its later stages by hematemesis, the vomited matter having a coffee-grounds appearance (black vomit). The patient does not perish of vomiting, however,—*i. e.*, as a result of inanition or exhaustion,—but of the profound toxemia as affecting the blood and higher nerve-centers. The vomiting, however, may be termed pernicious because of its grave prognostic significance, especially when "black vomit" is present. In this type, unless recovery can be brought about, death usually occurs within two or three weeks at the most, and often within a few days. Exceptionally, the condition may persist for many weeks, so that transitions occur between this and the following type, and in a certain number of cases the two are indistinguishable, save when in case of death an autopsy clears up the situation. The toxic nature of a case is then shown by evidences of the hepatic lesions of the toxemia of pregnancy.

(*b*) *Non-toxic Type.*—The other type of essential vomiting of pregnancy is known as the *non-toxic or inanition type*. Death occurs here purely from star-

vation, the patient living for a number of weeks, during which period the prognosis depends greatly on the ability of the medical attendant to control the vomiting.

The inanition type of vomiting, including certain cases in which the toxemia of pregnancy cannot be fully excluded, is so well known as to present certain classical features.

Etiology.—A hysterical or neurotic substratum is often in evidence through the numerous spontaneous and induced stigmata and symptoms of these conditions. Reflex excitability is also a powerful factor in determining the paroxysms of vomiting, and we therefore sometimes find evidences of a causal connection between various lesions and malpositions of the uterus and the emesis.

Symptoms.—For convenience, these are usually divided into three stages. *First stage:* A condition beginning as hyperemesis—usually in the first two months, but exceptionally during the sixth or seventh month—soon becomes incoercible by ordinary medical measures, and the complete rejection of the ingesta brings about more or less emaciation. During this stage the symptoms may often be controlled by special treatment, or may even cease spontaneously. *Second stage:* The pulse becomes small and feeble, the skin hot and dry, constipation is extreme, and albuminuria appears with casts. There are progressive emaciation and weakness. This stage may be prolonged for weeks, and at any time during this period induction of labor or fetal death may save the patient's life, although in a certain proportion of cases emptying the uterus is without effect. *Third stage:* This period indicates that the patient has become too weak to rally, even if vomiting ceases, which event often occurs. Premonitions of death are numerous, and to these are superadded cerebral symptoms—headache, delirium, stupor, etc. Death usually results from coma. These cerebral symptoms have no connection with the toxemia of pregnancy, but are connected with progressive inanition and possibly with the constant waste of gastric juice, which in animals is known to produce death amid similar symptoms.

Diagnosis.—We must be certain that the woman is actually pregnant, bearing in mind that pernicious vomiting may begin almost as soon as conception itself; and also that the emesis is not the result of an organic disease of the stomach, brain, kidneys, pancreas, intestines, peritoneum, etc. We must then exclude the toxemia of pregnancy, which is by no means easy in the milder forms of the latter, and is doubtless often impossible at the outset. Hyperemesis, associated with the so-called benign or petty manifestations of toxemia (see p. 296), need not be toxic itself. As a general rule, toxic vomiting is associated with other severe symptoms of toxemia.

Prognosis.—This is good rather than bad if proper treatment is instituted sufficiently early. If a toxic element is present, the prognosis depends in a large degree upon the early termination of pregnancy. Under other circumstances artificial abortion is practised only as a last resort. A severe first stage, passing rapidly into the second stage, is a rather unfavorable prognostic; and after the second stage is reached a marked daily loss of weight—over 10 ounces (300 c.c.)—and the presence of the diazo-reaction have a serious prognostic value. The prognosis for the fetus at or near term is relatively good.

Treatment.—Although I am not convinced that all cases of pernicious vomiting of pregnancy have an autotoxic origin, still I believe that a large proportion of these cases are due to hepatic insufficiency and toxemia, and that the best results will be obtained by treatment directed to this cause. Hence while

not ignoring entirely the value of *hygienic*, *dietetic*, *medicinal*, and even *local* treatment, I advise that treatment be promptly directed to the correction of an hepatic insufficiency and toxic blood-state, whether the clinical picture of the toxemia of pregnancy is present or not. Regulate the diet, and if necessary, nourish by rectal feeding; stimulate the liver and bowels by a full dose of calomel, and secure the action of the drug by high enemata of sulphate of magnesia; secure free action of the kidneys by diuretics, the free ingestion of plain water or colonic infusion of decinormal saline solution; cause the skin to act with hot packs and use oxygen freely for the lungs. Frequently repeated colonic irrigation and infusion are most valuable to relieve the toxemia or hepatic insufficiency and the intense thirst so often present. Likewise in severe cases intravenous infusion of the saline solution will prove valuable, and it should be resorted to early and repeated if necessary. My views upon the evacuation of the uterine contents are the same here as in the Preventive Treatment of Eclampsia.

The *hygiene* of the patient should be carefully regulated; kind treatment and pleasant surroundings are of the greatest value; sexual intercourse is to be prohibited; in grave cases the patient should remain in bed and perfect quiet and rest be enjoined. Many cases can be improved if the patients can be made unconscious of the fact of swallowing, either by spraying the fauces with a solution of cocain or by the use of the esophageal tube. Liquid food, such as milk and lime-water, eggs, beef-juice, koumyss, or clam-broth, should be tried; and if moderate quantities are rejected, the food should be given in teaspoonful doses at short intervals; at times it is most acceptable if given with cracked ice, in other cases very hot milk or broths are retained. Somatose and panopepton are of value.

Medicinal.—Among the medicines that are useful are the oxalate of cerium, in doses of from five to ten grains (0.3 to 0.6 gm.), with or without the subnitrate of bismuth; iodine (Churchill's tincture), one or two drops well diluted; menthol and cocain, either as a spray or internally, in small doses; carbonic-acid water, in small quantities or ad libitum; the same with the addition to each siphon of a drachm (4 gm.) of the bromide of potassium; tincture of nux vomica in ten-drop doses for gastric catarrh, and pepsin with diluted muriatic acid after food. Kleinwächter uses creosote, 15 minims (1 gm.) three times a day, combined with citrate of caffein and gentian, as an intestinal antiseptic. The inhalation of oxygen is serviceable even early in the disease. Nerve sedatives are sometimes very useful; the bromide of potassium or of sodium, with or without chloral, may be given in full doses per rectum. Codein may be given by the mouth or morphin hypodermatically; the latter may be given endermatically over the epigastrium when local tenderness exists. Other remedial agents are counter-irritation or the ether spray over the epigastrium, or the application of ice to the cervical vertebræ. Cases of success by the use of the electric current have been reported, the faradic current being passed through the stomach. Believers in the hysterical theory apply the measures which are most efficacious in the treatment of that affection. Thus, the woman may be separated from her friends and relatives and placed in a sanitarium. Sometimes the mere threat of isolation has produced a cure.

Local.—Malpositions of the uterus, and engorgement or hypertrophy of the cervix, should be corrected; erosions may be touched with a 10 per cent. solution of silver nitrate or with pure carbolic acid; the application of cocain to the cervix and the vault of the vagina has been reported to be successful in some cases. I have never found it of value. Dilatation of the internal os with a glove-stretcher dilator, so as thoroughly to rupture the circular fibers at this

point, is occasionally a successful procedure. At the same time any endotrachelitis, or erosions of the portio vaginalis, should be attended to. I have found that attention to these matters has apparently effected a cure. I have dilated the internal os in primigravidæ, curetted the cervical canal, scraped the cervix itself free from erosions, applied pure carbolic acid to the cervix and canal, and relieved the symptoms, without interrupting pregnancy, in a number of cases given up as hopeless and sent to the hospital to have labor induced. The finger will occasionally serve as a dilator, and in every case the greatest care must be used not to rupture the membranes.

Induction of Labor.—This will become necessary when there appears no other way of saving the mother, but we must never wait too long before resorting to this means, for although the vomiting always stops with the evacuation of the uterus, the woman may die from exhaustion.

Rectal Feeding.—This may become necessary, and should not be delayed too long. The physician must ever bear in mind that rectal alimentation has its time limit, that it cannot be continued for weeks, as some suppose; for during this time the patient grows progressively weaker, and the induction of labor is finally resorted to, too late to save the mother's life. Rectal feeding has been attended with variable results in the vomiting of pregnancy. Most commonly the injections have consisted of beef-tea, albumin water, defibrinated blood, brandy, milk, and peptones. A few drops of laudanum are sometimes added. Rectal injections must be given in small quantities, not more than five or six ounces, for fear of causing local irritation. At times the mere efforts of vomiting are so great as to cause the expulsion of the enema. The rectum should first be cleansed by the injection of a quart of water containing a teaspoonful of salt. One hour after the resulting evacuation the first rectal feeding should be given. Any kind of a syringe may be connected with a soft-rubber rectal tube and the nutriment thrown slowly into the bowel. The tube is then withdrawn and the patient instructed to lie quietly, in order that the enema may be retained. Three to five nutrient injections of from five to ten ounces may be given daily. The following substances are recommended for feeding: (1) Commercial peptones and propeptones, two or three ounces in each injection. Commercial beef-juices. (2) Milk and egg, a sort of eggnog, containing six or seven ounces of milk and one or two raw eggs, a teaspoonful of powdered sugar, a large pinch of salt, and a tube of Fairchild's pancreatin. (3) Pancreatized meat, five ounces of minced raw beef, one or two of fresh pancreas, an ounce of butter, and six ounces of water, all well compounded. These enemata should be given in rotation. In addition, the body receives a supply of water by daily rectal injection of saline infusion.* Pancreatized milk made with Fairchild's pancreatin may be used, also defibrinated blood. Flint's formula—milk 2 ounces (60 c.c.), whisky half an ounce (15 c.c.), with one half of an egg—may be used. Leube's pancreatic meat emulsion is a good preparation: 3 to 10 ounces (90 to 300 c.c.) of very finely chopped beef, one-third the quantity of minced pancreas (pig or ox), with the addition of lukewarm water and mixed in a mortar to the consistency of a thick soup. After each rectal injection the patient should retain the recumbent position on the left side with hips raised, for a time, while the nurse supports the anal region with a towel. Posenheim's formula is: glucose half an ounce; 2 eggs; peptone 1 to 2 drachms, and half an ounce of emulsion of cod-liver oil. Six per cent. solution of cocain should be applied to painful hemorrhoids.

3. Icterus.—Icterus being but a symptom and very infrequent as a complication of the toxemia of pregnancy, I do not give it special consideration.

* Einhorn: "Post-Graduate," New York, July, 1900.

Frequent references to the subject will be found under "The Toxemia of Pregnancy."

4. Eclampsia.—See also Toxemia of Pregnancy.—*Definition.*—By the terms eclampsia, puerperal eclampsia, and puerperal convulsions, is meant, in modern medicine, an acute morbid condition, making its advent during pregnancy, labor, or the puerperal state, which is characterized by a series of tonic and clonic convulsions, affecting first the voluntary and then the involuntary muscles, accompanied by complete loss of consciousness, and ending in coma or sleep. The disease may eventuate in death or recovery (Charpentier). Eclampsia may be gestational, intra-partum, and post-partum, or puerperal eclampsia proper.

Frequency.—Eclampsia occurs most often in the latter part of gestation, less often in labor, and least of all in the puerperium. The estimation of its frequency has been variously tabulated as 1 in 500 pregnancies, 1 in 250 to 300, 1 in 350 to 500—a variation of from 2 per cent. to 4 per cent. The complication is stated to appear in 1 per cent. of all cases of albuminuria of pregnancy. Schauta believes it to occur in 25 per cent. of all pregnancies. I found in 1200 cases of confinement, 800 of which were out-patient cases, that eclampsia occurred in 7 cases, or 0.58 per cent., or 1 in 171 cases. In another series of 1000 hospital cases it occurred in 3 cases, or 0.30 per cent., or once in 333 cases. Of the 10 cases, 8 occurred at the tenth month, 1 at the sixth, and 1 at the fifth.

Etiology and Pathology.—Eclampsia may be regarded as due to the autotoxic state of pregnancy as manifested chiefly in the latter months. For some reason, at present unknown, the autotoxic state has a special tendency at that period to attack the renal organs, and lead to the so-called kidney of pregnancy, which in its essential form is a temporary fatty infiltration of the parenchyma of that organ that disappears after delivery. In higher degrees of toxemia the kidneys undergo changes analogous to those of the liver in acute parenchymatous hepatitis and acute yellow atrophy. (See Toxemia of Pregnancy, p. 292.) In rare instances pregnant women who are suffering from antecedent Bright's disease develop uremia before delivery, this naturally simulating ordinary eclampsia (see "Diagnosis"); but this is the exception. Authorities who are only familiar with autopsy findings deny the existence of an essential pregnancy kidney, for in fatal cases we see the more severe lesions—acute parenchymatous nephritis with epithelial necrosis, renal atrophy, chronic nephritis in various degrees, etc. But the existence of an essential pregnancy kidney is shown by the fact that something like 75 per cent. of all cases of eclampsia recover, the urine, shortly after delivery, showing no abnormalities.

The autotoxic state when manifested late in pregnancy, as the forerunner of eclampsia, is not, as a rule, of the higher degrees; but the alterations present in the pregnancy kidney, while not destructive, are sufficient to impair the renal functions, so that a vicious circle is established in which the condition of the blood and metabolism, by their action upon the kidney, lead to a reaction on the part of the latter upon the former. Hence, ordinary eclampsia may be regarded as a complicated affair—a moderately severe toxemia plus renal inadequacy. When the toxemia is of such severity as to cause marked destructive lesions of the kidney, death rapidly supervenes—not from the urinary suppression, but from the intense basic toxemia through its immediate action upon the blood-state and the cerebral cortex. The conditions are not essentially different from those in which the patient dies of fulminant toxemia without renal complications of any sort.

In the majority of cases of eclampsia, in which we feel sure of the existence of the pregnancy kidney, it is stated that hepatic lesions are almost invariably

present, although these may be minimal and demonstrable only with the microscope. (See Toxemia of Pregnancy, p. 291.) However, the majority of these cases do not come to autopsy. In higher and usually fatal degrees of toxemia, when the renal lesions are presumably severe and destructive, the hepatic lesions may or may not be in proportion to the toxemia. In rare instances the kidneys may be practically destroyed with little or no evidence of hepatic lesions.

To sum up, the pathological findings of eclampsia necessarily embrace those of the basic autotoxic state, plus the alterations incidental to the pregnancy kidney. The cerebral lesions—hyperemia, œdema, thrombosis, hemorrhages—are doubtless aggravated by the repeated convulsions and perhaps by the heroic remedies demanded by therapeutic indications. This may also be true of the myocardial degeneration and bronchopneumonia, which some pathologists include among the autopsy findings.

Dührssen and others describe a mild type of eclampsia, without any evidences of toxemia or urinary abnormalities. They term this *reflex eclampsia.*

The predisposing and exciting causes of eclampsia enumerated in the older text-books have little force to-day. We are in complete ignorance concerning the tendency of the disease to develop late in pregnancy, in connection with primiparity, prematurity, twin gestation, and the like; and are equally ignorant as to reasons for the frequency of post-partum eclampsia (18 per cent.), and for the persistence of convulsions after emptying the uterus in something like 40 per cent. of cases. In regard to exciting causes they do not differ from those in convulsive disorders in general, where reflex excitability is necessarily present in high degree.

Symptomatology.—The symptoms of eclampsia may be considered under the prodromal period, or pre-eclamptic state, and those occurring during the attack. In the latter there are three stages: (1) invasion; (2) tonic and clonic convulsions; (3) coma. *Prodromal period, or pre-eclamptic state:* The symptoms of this stage are very important, for they offer a certain warning of an impending attack. There may be, as in epilepsy, a well-defined aura. After this, or even without it, there may be headache, tinnitus aurium, visceral disturbances, such as dizziness, amblyopia, amaurosis, epigastric pain, digestive and nervous disturbances, and a feeling of general debility. These are fairly constant in about one-fourth of all cases of eclampsia. At times there may be symptoms of involvement of the brain, stupor or insomnia, vertigo, vomiting, mental excitement, or despondency. These may all disappear, in which case there is a return of appetite, a more abundant perspiration and diuresis, and the patient falls into a refreshing sleep. Generally, however, the result is not so favorable, and the premonitory signs, or pre-eclamptic state, after lasting for several hours or days, give place to those of the *stage of invasion.* There is convulsive twitching of the lids, the eyes stare, and the pupils, which were at first contracted to a pin-point, are widely dilated. During the attack there is total insensibility to light. The face is cyanotic, and there is rapid and convulsive jerking of the muscles about the alæ of the nose and the mouth. The mouth is contracted to one side, there are rotation of the head and rolling up of the eyeballs. This is followed by the *stage of tonic and clonic convulsions.* The movements, which at first concerned only the head, now extend to the neck, trunk, and extremities, very infrequently, however, passing to the lower extremities. The neck is bent backward, and at last, together with the back, forms an opisthotonic curve; there are extension and rigidity of the arms, clenching of the hands, with the thumbs in the palms, and flexing

of the knees on the abdomen. The respiratory muscles, including the diaphragm, are involved by the tonic convulsions. Although the muscles of the chest are firmly contracted, there may be one or two spasmodic respirations at the height of the paroxysm. The tongue partly protrudes and, since it is often bitten, the saliva, which is frothy, is colored with blood. There is complete loss of sensation and of consciousness. The duration of the tonic convulsions is from ten to twenty seconds, and they are followed by clonic spasms. The clonic convulsions, as in the first of the attack, begin in the face, which becomes horribly distorted, and then extend over the body. Irregular and noisy respiration takes place, there are rapid opening and closing of the jaws, and the tongue may be again bitten. The patient may have to be held in bed, but generally the body retains its previous position. Eclampsia closely follows epilepsy in many clinical features. Thus, there are overlapping (subintrant) convulsions, a status convulsivus or continuous paroxysmal state (status epilepticus, status eclampticus), and an exhaustion-paralysis or temporary loss

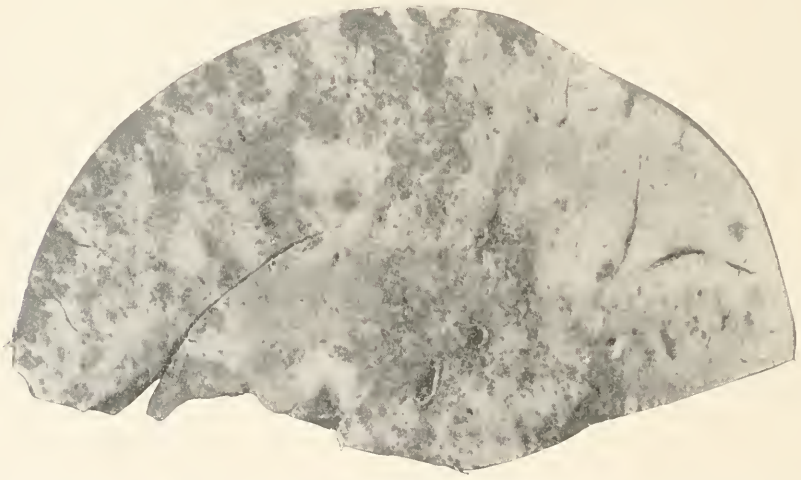


FIG. 470.—SEGMENT OF LIVER SHOWING HEMORRHAGIC HEPATITIS IN ECLAMPSIA (ACTUAL SIZE).—(*From a specimen in the Pathological Laboratory of the Cornell University Medical College.*)

of motor power in the convulsed muscles in both diseases. At the end of the attack full, labored, and stertorous respiration occurs. In one or two minutes follows the *stage of coma*. The duration of this period is about half an hour. Consciousness and sensation are slow to return. If a favorable issue is to take place, the patient falls into a deep sleep, and awakes to ask confusedly what has happened. After this stage mothers have denied their offspring born during eclampsia. Rarely there is but a single attack, and as a rule a number occur at varying intervals. If the seizures cannot be controlled, and death is inevitable, there are a progressive rise of temperature to 104° F. (40° C.) or more, and a small, rapid, wiry pulse. A semi-unconscious state follows, and death may occur during this period, or in the course of an attack, from pulmonary œdema, cerebral congestion, hemorrhage, or exhaustion. Patients who have survived the disease proper may die during the puerperium of some intercurrent affection.

The Effect upon the Fetus and Labor.—One attack is often sufficient to kill the

child. In twin pregnancy the death of one or both children may occur. However, the child may survive several attacks. Winckel notes an interesting fact, that if the fetus is killed and pregnancy not interrupted immediately, labor both in its onset and course may be free from convulsions. In view of the shock, nervous disturbance, and uterine contractions, there is apt to be an abrupt termination of pregnancy. If the attack takes place in labor, there is increase of the pains from general muscular excitement, so that the child may be born while the physician is engrossed with the care of the mother. There is involvement of the kidneys in about two-thirds of the cases of eclampsia. In 84 per cent. the urine contains albumin, varying in quantity even to 2.5 per cent., or higher. There are an increase of albuminuria with each attack, and a rapid decrease after its subsidence. As a prodrome this is important. The urine generally contains sugar and formed elements, red and white corpuscles, as well as casts; that is, there are present symptoms of acute congestion of the kidney.

Diagnosis.—Convulsive affections other than typical eclampsia may occur during pregnancy. Some of these stand in some near relationship to eclampsia, while others do not. Thus, acute toxemia of pregnancy may be associated with incidental or terminal convulsions, which may or may not resemble those of typical eclampsia. When the resemblance is marked, yet without evidences of renal disorder, the condition is termed *cholemic eclampsia*, because accompanied by the picture of acute hepatic insufficiency. Atypical convulsions may or may not accompany the most acute type of acute toxemia of pregnancy (p. 296). Finally, in women with nephritis who become pregnant, true *uremic convulsions* may occur, although the reverse is usually the case. Typical eclampsia, due to secondary renal lesion, is readily distinguished from the other forms enumerated by the pre-eclamptic stage, the progressive character of the convulsions with increasing temperature, the evidences of renal impairment, the response to proper treatment, etc., etc. There is probably no guide, nor is there any great necessity for differentiation between atypical eclampsia and the convulsions due essentially to the toxic state of pregnancy, for the conditions are closely allied. Uremia is distinguished from eclampsia chiefly by the absence of fever, and also by a history of Bright's disease; but the distinction is not of great importance, for the treatment of the two conditions is practically the same. It must be borne in mind that *eclampsia without convulsions* may occur, *i. e.*, evidences of pregnancy-kidney, pre-eclamptic state, œdema, retinitis, etc., may not be followed by convulsions, but instead pass directly into stupor. Such a condition is extremely rare, but not difficult to understand when we bear in mind that in some cases of atypical eclampsia very few convulsions occur.

Of convulsive states which may simulate eclampsia without being allied to it, are *epilepsy* and *hysteria major*, on the one hand, and the convulsions of acute intercurrent diseases (*meningitis*, for example) on the other. Epilepsy and hysteria should not be accompanied by toxemic phenomena, and the distinction ought to be readily made. The status epilepticus and status hystericus might, by reason of their continuous convulsions, stupor, high temperature, etc., readily simulate eclampsia, although the history of the case should clear up the obscurity. The convulsions of meningitis are local, while those of eclampsia are general. *Apoplexy* rarely occurs in pregnancy. There are no prodromes. Coma quickly follows.

Prognosis.—In 10 cases of eclampsia occurring among 2200 cases of labor I found the maternal mortality was 2 cases, or 20 per cent. Of the viable children, all lived. Puerperal eclampsia is still a very grave affection. Many statis-

tics show, even at the present time, a maternal mortality of 30 per cent., while that of the child reaches 50 per cent. There is imminent danger of a seizure in the pregnant woman who shows marked symptoms of toxemia, albuminuria, and the quantity of whose urine is gradually decreasing. The danger becomes more pronounced in proportion to the increase of the albumin, the decrease of the water excreted in the twenty-four hours, and the departure of the nitrogen compounds of the urine from their normal standard indicates faulty metabolism. As these conditions are reversed, to a corresponding extent the peril becomes more remote. The amount of urea excreted is a more important factor in prognosis than that of albumin, as has been clearly shown by Bouchard and Davis. Davis discovered that the symptoms of toxemia decrease with the increase of urea. The gravity of the prognosis increases in proportion to the early stage of pregnancy at which the convulsion occurs. It has been demonstrated by Schauta many times that all derangements, even those of renal origin, subside after the child's death; thus the prognosis will improve in repeated attacks in proportion to the early occurrence of its death. Profuse sweating, especially of early occurrence, is a favorable sign. The prognosis becomes most unfavorable when the seizures take place in pregnancy, when they follow one another rapidly, when they become gradually more pronounced, and when they have existed for an extended period before assistance can be obtained. Mortality has been decreased by chloroform treatment in these cases. Briefly, the prognosis is favorable when: (1) The attacks are far apart and not severe. (2) The child perishes. (3) The patient has conscious intervals between the attacks. (4) The quantity of albumin is small. (5) Decrease of temperature occurs. (6) The seizures take place in advanced labor or during the puerperium. Prognosis is not favorable when opposite conditions exist.

The vitality of a child born of an eclamptic mother is below normal, and it often dies in the first twenty-four hours. The mother may succumb from exhaustion; cerebral apoplexy due to forcible rupture of the vessels; asphyxia caused by spasm of the glottic and respiratory muscles; œdema of the lungs or of the brain, following a serous effusion from overcharged capillaries; congestion of the brain, in which coma is the chief symptom; or cardiac paralysis. The last, when taking place during the general convulsion, is followed by instant death. The child's death may be due to maternal convulsions and the pressure resulting therefrom; asphyxia, caused by compression or œdema of the placenta, or an extreme amount of carbon dioxide in the blood; or it may be by direct poisoning by the toxins in the maternal circulation.

Treatment.—The best etiological theory of the present day, although it may not be correct in all details, is that eclampsia is due to toxemia. Taking this for granted, then, the prophylactic treatment of eclampsia is far more important than the curative, since it is usually possible to prevent the attack. Many prominent American as well as foreign obstetricians hold this opinion.

The Preventive Treatment.—The pre-eclamptic symptoms comprise a rapid pulse, generally accompanied by high arterial tension; anorexia, gastrointestinal derangements; mental and physical lassitude; headache; decrease of all the excretions, both solid and liquid, either gradual or rapid; that is, just those disturbances that might be expected from the introduction or retention in the circulation of some toxin. The quantity of urine excreted in twenty-four hours is not always to be depended upon as an exact guide to renal failure. As has been stated, albuminuria may be wanting before, during, and even after an eclamptic convulsion. (See Toxemia of Pregnancy.) The eclamptic tendency increases proportionately with the advance of

pregnancy and the consequent increased fetal metabolism. Besides, it is well known that the mortality of the mother decreases gradually from the ante-partum to the post-partum condition; that is, it is maximum when the onset of eclampsia occurs during pregnancy, diminished during labor, and is minimum when the seizure takes place for the first time after the child is born. Thus statistics tabulated by Green * show the maternal mortality in ante-partum eclampsia to be 46 per cent.; fetal mortality, 69 per cent.; in intra-partum eclampsia, maternal mortality, 25 per cent.; fetal mortality, 25 per cent.; in post-partum eclampsia, mortality of mother 7 per cent. There is offered, from the present knowledge of the etiology of puerperal eclampsia, at least a working hypothesis—namely, the early recognition of the pre-eclamptic stage. In addition to the monthly or bi-monthly examination of the urine for the detection of albumin, something more is needed, since non-albuminuric eclampsia exists in from 9 to 16 per cent. of cases, and it seems quite as fatal as albuminuric eclampsia, sometimes more so. In addition to the physical signs of decided kidney inadequacy, as an index of impending eclamptic seizure, we should watch for the general symptoms of a circulation overcharged with poisonous material—high arterial tension, headache, dizziness, gastric disorders, mental and physical lassitude; and for disturbances of the bowels, liver, skin, and lungs, and their failure properly to perform their functions, in order that the patient may be intelligently treated. Under these conditions only is the whole duty of the physician to the patient accomplished. The following is the line of treatment suggested by me for this state: (1) *The amount of nitrogenous food should be diminished to a minimum.* (2) *The production and absorption of poisonous materials, in the intestines and body-tissues, should be limited and their elimination should be aided by improving the action of* (a) *the bowels*, (b) *the kidneys*, (c) *the liver*, (d) *the skin, and* (e) *the lungs.* (3) *The source of the fetal metabolic products, and the peripheral irritation in the uterus should, if necessary, be removed by evacuating that organ.* The first indication, reduction of the quantity of nitrogenous food, can be best met by an exclusive milk diet, to which, as the symptoms improve, fish and white meats may be added. It is more agreeable to the patient, and a safer course to pursue, to begin at once with an absolute milk diet, than to compromise, and later to institute a strict milk diet. An abundant supply of pure air and water must be offered for the second indication, that of elimination. To this may be added gentle exercise or light calisthenics, or even massage, in some instances. In treating the bowels the writer advises the use of daily doses of colocynth and aloes at bedtime, followed by a saline the next morning. For the liver, I find efficacious an occasional dose of calomel and soda at bedtime, followed in the morning by one of the stronger sulphur waters, as Rubinat, Villacabras, or Birmensdorf. Large doses of glonoin are excellent to increase diuresis. To encourage the function of the skin, the body should be clothed in wool or flannel, massage may be used, and, according to the severity of the case, the warm bath, hot bath, hot pack, or hot-air bath may be resorted to. A definite diaphoretic-diuretic action, together with the additional prompt effect upon the liver and intestines, is obtained by the following treatment: A tablet composed of calomel, digitalis, and squill, each 1 gr. (0.06 gm.), and muriate of pilocarpin, $\frac{1}{20}$ gr. (0.003 mg.), is given. The next morning a full dose of Villacabras water is administered. Thus four of the five eliminative processes are urged to perform their functions more energetically. I approve of the use of jaborandi

* Green: "Puerperal Eclampsia: Experience of the Boston Lying-in Hospital in the Last Eight Years," "Amer. Jour. of Obstet.," 1893, 28, 18–44.

in the pre-eclamptic state, provided there is no pronounced cardiac disease, although it has been generally abandoned as a diaphoretic during the eclamptic seizure. Inhalations of oxygen are beneficial when a sufficient supply of fresh air is wanting, and in cases in which exercise cannot be taken. Some preparation of iron is indicated, as Basham's mixture, or the tincture of the chloride. Each case must be treated individually; no absolutely definite rules can be followed; but the preceding suggestions comprise the general hygienic and medicinal treatment of the pre-eclamptic state. In certain cases a restricted diet and gentle stimulation of the functions of the kidney and intestines are sufficient, and the patient may be allowed a certain freedom, even exercise in the open air, the skin being protected by wool or flannel. In more severe cases of eliminative insufficiency the patient must be kept perfectly quiet in bed, allowed only a strict milk diet, while all of the eliminative organs must be stimulated in order to remove the symptoms of impending eclampsia. However, it should be thoroughly understood that the milk diet is the cornerstone of the preventive treatment of puerperal eclampsia, the hygienic and medicinal treatment being only of secondary importance. In a case in which, despite an exclusive milk diet and the energetic stimulation of the five eliminative processes, the symptoms and signs of the pre-eclamptic state still persist, or at any time become urgent, abortion or artificial premature labor is indicated. The ideas of those authorities (especially of the British school of midwifery) who do not, in the presence of urgent symptoms, approve of inducing labor in the pre-eclamptic state are difficult to understand. However, attention must be paid to the arguments that labor induced by the usual methods increases reflex excitability and precipitates convulsions; that by such methods the patient's fate is sealed before delivery, on account of the time necessary to eliminate the barrier of the cervix; and, lastly, that the patient's danger is increased by the onset of labor. In reply, it may be stated that the methods of terminating the pregnancy advised here need not necessarily increase reflex excitability, and, should they do so, it is easy to control the excitability for the time necessary to attain our ends; that the necessary time is generally very short; and, indeed, that at the present time the onset of labor and the termination of pregnancy may be practically synchronous, and that there is consequently no extended or tedious labor to exert its unfavorable reactions upon the patient. Byers* made the objection that, on account of the necessary manipulation, induced labor increases the risk of sepsis. This, however, should not prevent the modern obstetrician from undertaking the operation when he is assured of being surgically clean. Charles, of the Liége Maternity, gave statistics at the International Congress of Obstetrics and Gynecology in 1896 which were greatly in favor of this procedure, of induced labor, when prophylaxis fails or the pre-eclamptic symptoms become urgent. His table demonstrates that every mother recovered and 75 per cent. of the children lived. I strongly advise a quick manual dilatation of the os in these cases; only, however, after the cervical canal is in a condition suitable for its safe performance. I would also insist upon a complete dilatation of the os, before the operator undertakes to deliver the patient.

The Curative Treatment.—An eclamptic seizure presents a desperate condition. From various parts of the world the most recent statistics continue to estimate the maternal mortality at from 25 to 35 per cent. Rational curative treatment of this affection will remain impossible as long as its pathology continues obscure. From experience no one treatment can be recommended

*Internat. Congress of Obstet. and Gynecology, Geneva, Sept., 1896.

for all cases. No matter what treatment may be pursued, many women recover, many die in spite of treatment, while others do well with no treatment at all. No one treatment, then, can be advised; each case must be attacked in accordance with the existing indications. A combined treatment gives better promise than a single, for preserving the lives of mother and child, in the event of an eclamptic attack. For this combined treatment the three following indications are offered: (1) Control the convulsions; (2) eliminate the poison or poisons which we presume cause the convulsions; (3) empty the uterus under deep anesthesia, by some method that is rapid and that will cause as little injury to the patient as possible. These indications, though stated in the order of their importance, still may be carried out synchronously. In another class of cases the first and second indications should be fulfilled, while the physician waits for a suitable moment to undertake the third. The second indication, elimination, logically accompanies the first and third, and should be undertaken at the same time with them.

1. *Control of the convulsions.* The most effective as well as the safest medicinal anti-eclamptics are chloroform, morphin (hypodermatically), veratrum viride, and chloral hydrate, the latter being used alone or in combination with the bromide of sodium. I prefer chloroform, veratrum viride, and chloral, in the order stated. For the last three years I have abandoned almost entirely the use of morphin, since it seems to prolong the post-eclamptic stupor, while it increases the tendency to death during coma, by its interference with the eliminative processes. The most reliable of all agents for immediate control of the convulsive attacks is chloroform. Veratrum viride in efficiency stands second only to chloroform. With the pulse strong as well as rapid, it offers the most certain means at our command for temporarily, and even permanently, controlling the spasms. With a weak pulse, morphin hypodermatically, inhalations of chloroform, and chloral administered per rectum, together with stimulation, if necessary, may be used instead. The pulse-rate is diminished by veratrum viride, and convulsions are almost unknown when the pulse-rate is 60 or under; the temperature also is reduced, and the rigidity of the cervical rings is relaxed; diaphoresis and diuresis are promptly effected, so that, by the use of this drug, our first indication, the control of the convulsions, is fulfilled as well as the third, the elimination of an unknown toxin. The initial dose of the tincture of veratrum viride, given subcutaneously, should be generally from 10 to 20 minims (0.6 to 1.2 gm.); an additional 10 minims (0.6 gm.) may be administered by the same method every succeeding half-hour, till the pulse continues below 60 to the minute. While under the influence of the veratrum, the patient should be kept in a recumbent position. Tumultuous heart-action will probably supervene when the erect position is assumed. Whiskey or morphin will easily control vomiting and collapse, if they occur. Rapid evacuation of the uterus is the final resort for the control of the convulsions. However, it might be stated that ice-bags to the back of the head and neck have a decided effect in controlling and in preventing convulsive seizures.

2. *Elimination of the poison or poisons which are presumed to cause the convulsions.* The following means may be advised to eliminate the poisonous material from the blood and tissues. Not only one, but all of the eliminative organs of the body should be brought into play, and the following indication in eclamptic treatment should be carried out along with the two previously described methods. As early and prompt catharsis as possible should be obtained, by means of croton oil, compound jalap powder, or calomel followed

by salines, and high enemata of magnesium sulphate. The writer prefers to treat the comatose condition, or post-eclamptic stupor of the affection, by repeated doses of concentrated solutions of magnesium sulphate or Villacabras water, administered by means of a long rectal tube, high up in the descending colon. Hypodermatic injections of the sulphate of magnesium have been demonstrated to be too slow and ineffective to accomplish any good. Dry or wet cups over the kidneys, followed by hot fomentations, is an excellent method of causing diuresis. Glonoin is invaluable as a diuretic and anti-eclamptic, the latter indication being fulfilled by diminished arterial tension. Veratrum viride stands next in order of efficiency. The objects of its administration, at this time, are similar to those in the pre-eclamptic condition. The hot-air bath or the hot pack encourages diaphoresis, the writer preferring the former. On account of the danger of pulmonary and glottis œdema, incident to the use of pilocarpin as a diaphoretic, in the existence of an eclamptic seizure, its use should not be countenanced. I have seen improvement result from venesection followed by intravenous saline infusion, thus securing a cleansing and disintoxication of the blood and tissues. Care must be taken that no great disturbance of the blood-pressure is produced. Thus, in cases of high arterial pressure the amount of saline should not exceed and may even be less than the amount of blood withdrawn. I have also obtained satisfactory results by extended irrigation of the lower bowel, using either decinormal saline solution or sterile water, by means of a long, single or return-flow tube. Collapse attended by a small compressible pulse, as in the same conditions under other circumstances, is effectively treated by the introduction into the blood of a decinormal saline solution. Some authorities advocate the hourly subcutaneous injections of ether as a diuretic. Abundant administration of oxygen is invaluable as a general stimulant, to assist the eliminative function of the lungs, and to sustain life in post-eclamptic stupor or coma. Alcohol is often a necessary stimulant, both during and after an eclamptic seizure, and strychnin has proved effective in the post-partum condition, and with impending collapse; although, reasoning from a physiological standpoint, it would seem to be contraindicated.

3. *Emptying the uterus under deep anesthesia, by some method that is rapid and that will cause as little injury to the woman as possible.* Careful observations seem to show that danger is essentially passed, in some 90 per cent. of cases, immediately after the uterus has been emptied, if this is accomplished early in the seizure. The convulsions do not always cease by this method, but they become less dangerous, and the case is converted to one of post-partum eclampsia, in which, as has been stated, the mortality is only 7 per cent. It seems from the reports of the International Congress at Geneva, September, 1896, and from the literature of the last ten years, that the best authorities are in favor of emptying the uterus as quickly as possible, in cases of eclampsia, whether the attack takes place before or during labor, although the opinion as to the method to be employed varies widely. Nevertheless, in the second stage of labor, after securing dilatation, all are agreed that there is indication for the immediate emptying of the uterus, and this operation should be promptly performed. This is accomplished with no additional danger to mother or child. In pregnancy and the first stage of labor, the barrier offered to rapid delivery is the undilated cervix, and it is just here that obstetricians hold such different opinions as to the best plan of procedure. Expectant or palliative treatment will almost surely be followed by death of the child, and about one-third of the mothers succumb. But if the uterus is promptly evacuated by suitable surgical means, the child's life is preserved and the mother is practically subjected to no danger. During preg-

nancy and early labor four methods are suggested for quickly emptying the uterus: (1) Cæsarean section (suprapubic and vaginal); (2) mechanical dilatation of the cervix (various methods); (3) deep incisions, which at once completely remove the barrier of the cervix; (4) combined mechanical dilatation and deep cervical incisions. A high mortality (36.26 per cent., according to the figures of Charpentier) attends the first method—Cæsarean section—for the relief of eclampsia. The popular method of the present day seems to be mechanical dilatation of the cervix, and the prompt extraction of the fetus. This method is safe and effective when properly performed. However, the safe performance of this method will demand from forty minutes to an hour and a half before dilatation is well advanced. Certain cervical conditions, even with this allowance of time, will not yield to manual dilatation, or else entail lacerations of the lower uterine segment. By the third method of delivery, that of deep incision of the cervix, is presented a surgical means for emptying the uterus in from five to ten minutes, on condition that the supravaginal portion of the cervix has disappeared, either of itself or by the application of appropriate measures. The fourth method comprises a combination of the second and third, and is suitable for cases in which the supravaginal portion of the cervix has not disappeared, and prompt emptying of the uterus is indicated. In this method the os is mechanically dilated until the internal os has disappeared, when the dilatation is at once completed by means of the incisions. There are few statistics to offer concerning the results of the third method and its modification, the fourth, on account of their comparatively recent introduction. In general, the indications will be fulfilled by a prompt manual dilatation of the os, followed by extraction of the fetus; however, unless this can be expertly carried out, with an intelligent understanding of the mechanism of dilatation, particularly in primiparæ, more favorable results will be attained by a strictly expectant treatment. Although the mortality is greater in multiparæ, nevertheless, puerperal eclampsia is unfortunately four times more frequent in primiparæ. The cervix uteri consists of muscle-fibers, both constricting and dilating, and while it is known that labor is generally induced by the first convulsions, nevertheless the supervening asphyxia

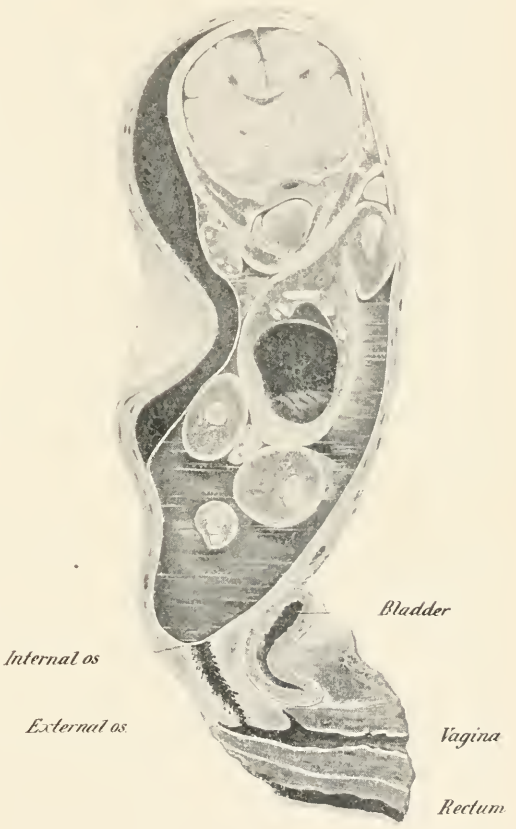


FIG. 471.—FROZEN SECTION OF THE UTERUS OF A MULTIGRAVIDA AT THE THIRTY-FOURTH WEEK, WHO DIED BEFORE ANY LABOR PAINS OCCURRED. Note the length of the cervical canal and the closed condition of the internal os.—(*Leopold.*)

has a decided constricting influence upon the body of the uterus and the cervix, which is most definitely exemplified at the internal os. Consequently, there will be imminent danger of uterine rupture in any method of rapid manual dilatation of the os undertaken before the internal os has at least partly disappeared. This fact particularly concerns primiparæ, in whom the supravaginal portion of the cervix persists late in pregnancy, and even up to the beginning of labor. Uterine rupture and death have not infrequently followed the careless performance of rapid manual dilatation of the os, especially in eclampsia; and undue shock has been caused by dragging a fetus through an imperfectly dilated os, not to speak of the death of the child. Hence the greatest care in this manipulation is demanded. In case of placenta prævia, the lower uterine segment and the cervix are made more easily dilatable by the hemorrhage and supervening anemia. The reverse is true in eclampsia, as has been before suggested. Great care should be taken not to extract the fetus prematurely, before full dilatation has been attained and the external os paralyzed. I have seen cases of premature extraction, under these circumstances, which have been followed by many unnecessary and dangerous lacerations of the lower uterine segment, and by an increased mortality of both mother and child.

Although I have the strongest faith in the efficiency of an immediate removal of fetal metabolism and irritation, in order not only to control but to cure the eclamptic attack, I must protest, first, against the careless use of the term *accouchement forcé* as applied to the rapid, scientific, and intelligent evacuation of the uterus; and, secondly, against the thoughtless recommendation of this method as being the best, if not the only one at our command, for controlling eclamptic convulsions, without giving due consideration to the condition of the cervical barrier.

Accouchement forcé comprises to-day three operations—namely, (1) the complete instrumental or manual dilatation of the cervical canal, followed by (2) either combined or direct version, or the application of the forceps, and (3) the immediate extraction of the child. It is well for the patient suffering from an eclamptic seizure that the frequency of the convulsions increases proportionately with the progress of pregnancy. As already stated, it is unfortunate that the eclamptic seizure is four times more frequent in primiparæ than in multiparæ, and in primiparæ the persistence of the supravaginal part of the cervix, even to late gestation, and of a rigid and unrelaxing os, necessitates the use of preliminary and temporizing methods before a rapid dilatation of the os and subsequent extraction of the fetus can be safely performed. In these cases which are so critical, after the institution of measures preparatory to a rapid dilatation and evacuation of the uterus and waiting for them to culminate, so that at least the cervical canal may have been rendered somewhat relaxed, even if the internal os has not partly disappeared, my experience has proved veratrum viride invaluable, for the preservation of life, on account of the various characteristics of the drug, before described. Vaginal Cæsarean section should also be considered in such cases as a substitute for mechanical dilatation.

XI. DISEASES OF THE URINARY TRACT.

1. Passive Congestion of the Kidney. 2. Acute Nephritis. 3. Chronic Nephritis. 4. Floating Kidney, Tumors of the Kidney. 5. Pyelonephritis. 6. Hydronephrosis. 7. Renal Calculi. 8. Renal Insufficiency, and Toxemia. 9. Vesical Irritation. 10. Cystitis. 11. Incontinence of Urine. 12. Urinary Retention. 13. Vesical Hemorrhoids. 14. Vesical Calculi. 15. Cystocele. 16. Vesical Neoplasms and Traumatism. 17. Albuminuria. 18. Polyuria. 19. Peptonuria. 20. Hematuria. 21. Glycosuria. 22. Lipuria and Chyluria. 23. Acetonuria. 24. Urinary Sediments of Pregnancy.

1. Passive Congestion of the Kidney.—This condition, when due to any obstruction of the return flow of venous blood, may, of course, complicate pregnancy; but the term is usually applied to a supposed consequence of the pressure of the gravid uterus itself. *Anemia of the kidney:* But since the increased intra-abdominal pressure of pregnancy affects the renal arteries as well as the veins, the tendency is naturally toward an anemic rather than a passively congested kidney. This anemia is assumed to be the forerunner of albuminuria and fatty degeneration; or, in other words, is the first step in the formation of the so-called kidney of pregnancy. Its existence is naturally associated with the latter part of pregnancy, after the gravid uterus has attained a certain size; but some see in anemia of the kidney a reflex element, believing that compression of the nerves in the uterus causes a lowering of blood-pressure in the kidney. *Pregnancy-kidney:* This important condition is considered under toxemia of pregnancy, eclampsia, and albuminuria. It is enough to state here that it is essentially a fatty degeneration or infiltration of the renal epithelia which varies much in degree, but which with very few exceptions undergoes complete resolution after delivery. There is more or less tendency toward recurrence at subsequent pregnancies.

2. Acute Nephritis.—Acute nephritis may develop during pregnancy as a purely accidental complication, differing in nowise as to etiology, symptoms, etc., from the same affection as it occurs in the non-gravid. The fact that such a condition is to be construed for practical purposes as a severe form of pregnancy-kidney—with which, however, it has no known relationship—makes it necessary to state but little under a separate heading. Acute nephritis is attended with greater local and general disturbance, and its prognosis as a disease *per se* is less favorable. It tends to cause uremia, while in pregnancy-kidney the toxic state is believed to precede the renal lesion. In cases in which a differential diagnosis cannot be made between acute intercurrent nephritis and pregnancy-kidney, it will be difficult to decide whether the toxic state is uremic or eclamptic. Recent studies in cryoscopy show a difference in the blood in these conditions; so that the differentiation should be rendered absolute. Finally, acute nephritis, although it might possibly end in resolution in time, would have no necessary tendency to terminate with delivery, and would in most cases result in chronic nephritis, a termination unusual—and according to some, unknown—in pregnancy-kidney.

3. Chronic Nephritis.—Chronic nephritis sometimes becomes apparent after conception in the absence of any previous suspicion of the disease. If a woman show the evidences of renal lesion very soon after impregnation, the inference is that the affection is of considerable duration. It happens occasionally that a woman with chronic nephritis becomes pregnant when fully aware of her condition. The influence of gravidity is usually serious, and becomes more marked for each successive pregnancy. The mother may be variously affected. She may die as the result of labor if the latter is severe in character or complicated by

operative intervention. Or the confinement may be uneventful, but the disease may undergo a severe, perhaps fatal, exacerbation during the puerperium. It is known that these patients readily become septic, and that very slight traumatisms may become infected. While opinion is divided as to the advisability of interrupting pregnancy in pregnancy-kidney and in acute nephritis, authors agree that intervention of this sort is more justifiable in chronic nephritis. The remarkable infrequency of eclampsia in chronic nephritis of pregnancy is an argument in favor of the distinction between uremia and the toxemia of pregnancy.

4. Floating Kidney; Tumors of the Kidney.—These conditions very seldom complicate pregnancy and labor. The pressure of the gravid uterus, as a rule, suffices to keep a floating kidney in place for the time being, and the chief danger from this abnormality is during and after the puerperium, when it may become aggravated. If the displacement is congenital, or if it occurs suddenly during labor, the kidney may enter the pelvis and become incarcerated. The pedicle of an ordinary floating kidney may become twisted.

5. Pyelonephritis.—This condition was formerly unrecognized, having been confounded with cystitis. In 1889 Kruse * first called the attention of obstetricians to this complication, and in 1892 Reblaud published a monographic study of the subject. *Frequency:* Pyelonephritis of pregnancy is far from rare. According to Vinay, at least one case occurs annually, on an average, in the Hôtel-Dieu Maternity, Paris. *Etiology:* This is entirely obscure. Compression of the ureters, especially the right, by the gravid uterus will not account for the lesion. Vinay † and Reblaud both accuse Bacillus coli of active responsibility, the latter even holding that it gains access to the urinary tract by direct propagation through the intestine. In support of this contention Bue claims that purgation aborts pyelonephritis. *Symptoms:* The disease may make its appearance at any period after the fourth month. The symptoms, while obscure, are usually those which characterize a severe acute disease, including a chill, high temperature, malaise, etc. Pyuria is present, associated with albuminuria. *Diagnosis:* This is made by exclusion of cystitis. There is induced tenderness over the kidneys. *Prognosis:* The disease persists until pregnancy is terminated. It may recur with successive pregnancies. Statistics are rare. *Treatment:* The indications are rest in bed; sedation (hypodermatics of morphin), milk diet and intestinal antisepsis. Vinay recommends benzo-naphthol for this purpose. The disease does not appear to be severe enough to require the induction of abortion.

Pyelitis is very rare during pregnancy, being far more common in the puerperium. (See Part VII.)

6. Hydronephrosis.—This affection may occur as a result of pressure on the ureters by a uterus bound down by adhesions or by twisting of the pedicle of a dislocated kidney. The uterus or kidney should be replaced and held in position if possible. Interruption of pregnancy usually occurs.

7. Renal Calculi.—Renal colic is rare in pregnant women because of its infrequent occurrence in the female sex in general. The few published cases are probably simply coincidences and the sole interest in considering the subject in this connection is the simulation of labor pains by the colic. The treatment of the affection differs in nowise from that in the non-pregnant.

8. Renal **Insufficiency.**—See Toxemia of Pregnancy.

9. **Vesical Irritation.**—This must not be confounded with cystitis, incontinence, or retention, although some of these conditions may occur side by side. It may be described as an almost physiological reaction on the part of the bladder toward the irritation of the pregnant uterus. The organ is compressed

* Inaug Dissert., Würzburg.

† "L'Obstétrique," May 15, 1899.

between the symphysis in front, and the gravid uterus behind. It is an affection most complained of in the early months of pregnancy and in primigravidæ, and tends to disappear about the fourth month of pregnancy, but often returns in the last fortnight.

Symptoms.—The affection is a dysuria. There is a frequent desire to urinate, with pain and scalding. The symptoms resemble those of cystitis but are less severe. The distress is removed if the patient takes the recumbent posture for the time being. The bladder is usually hypersensitive. In case of malposition of the uterus the pressure is usually directed against the neck of the bladder, and vesical tenesmus results. If the vesical neck be forced against the upper border of the symphysis pubis, there may be retention of urine (page 318). This may cause incontinence or the urine may be completely retained and the bladder will be overdistended. In this condition, if labor supervenes, rupture of the bladder may take place, on account of the decrease of abdominal space caused by the retraction of the walls. Cystitis commonly follows overdistention. Abnormal presentations and positions of the fetus cause irritability of the bladder in the latter months of pregnancy. There is either extreme pressure on the bladder or this organ is pushed out of place. The fetus should be replaced in normal position, which can be accomplished only by external manipulation.

Treatment.—The measures for relief are those employed in vesical irritation in the non-pregnant, or as in cystitis, to be mentioned later (rest, dorsal decubitus, baths, anodynes, etc.). Catheterization should be avoided unless absolutely demanded. A normal presentation of the fetus should be secured if possible by external manipulation, and an abdominal binder (Figs. 228 and 229) used, which will relieve the bladder of fetal pressure. I have found the modified knee-chest posture (Part X), used twice daily, of great benefit in obtaining relief.

10. Cystitis.—Cystitis of pregnancy is not a rare disease.

Etiology.—It may originate from some of the minor urinary troubles developing early in pregnancy, such as retention due to retroversion. The actual determining cause is bacterial, and a number of germs are known to give rise to the disease, including Bacillus coli and Staphylococcus pyogenes. These germs appear to be unable to infect the normal bladder. Gonococcus cystitis is rarely seen in pregnancy. Cystitis arises either through importation of germs by the catheter or by their spontaneous migration from the vestibule along the urethra.

Symptoms.—These consist chiefly in increased frequency of micturition and more or less scalding with tenesmus at the close of the act, at which time a blood-clot may be expelled. Such a urine, upon standing, deposits a heavy sediment consisting of pus-corpuscles. The type of cystitis which follows upon the irritable bladder of early pregnancy is always mild; it may be readily overlooked and mistaken for simple urinary irritation unless the urine is carefully tested. On the other hand, the cystitis of retention is severe and aggravates the already existing state of affairs. The retained urine may readily decompose, the pus being transformed thereby into a ropy mass. The combination of retention with cystitis has been known to produce abortion. The disease tends to improve after delivery, but sometimes persists. In some women cystitis tends to recur with each pregnancy.

Treatment.—Rest and avoidance of exposure are the first considerations. Hence, in winter patients had better be confined to bed. The diet should be extremely simple, consisting chiefly of clear soups, green vegetables, and farinaceous articles. Alkaline mineral waters should be taken freely. Any diuretic infusion may be prescribed, with the additions of sandal-wood in capsules or

salol. Poultices should be placed over the hypogastrium and anodyne suppositories may be necessary in severe cases. Urotropin is also of value.

11. Incontinence of Urine.—True incontinence is rare in pregnancy, although it is by no means unknown in the later months. It should not be confounded with the ordinary vesical irritability, which is almost inevitable, nor with the dribbling which accompanies retention. The principal cause is the encroachment on the bladder of the more dependent portions of the fetus during the last weeks of pregnancy. If the fetus press fairly upon it, any sudden movement of the diaphragm, as in laughing, coughing, etc., could readily cause the emptying of the viscus. The constant escape of urine may give rise to excoriations of the vulva and thighs. An abdominal bandage will usually relieve this condition (Figs. 228 and 229).

12. Urinary Retention.—This is conceded to be the most prevalent of all the urinary anomalies of pregnancy, owing, perhaps, to the number of types which the condition assumes. These are as follows: (1) Retention at the onset of pregnancy. The rationale of this is obscure. This is attributed to reflex spasm of the vesical neck. (2) Retention in the course of pregnancy. This is due almost exclusively to retroversion of the pregnant uterus, and begins at the third or fourth month. (3) Retention toward the close of pregnancy. This is the result of the direct compression of the urethra and bladder by the fetal head.

Symptoms.—These are self-evident—the urinary tumor and the failure to pass water beyond a mere dribbling. This dribbling saves the patient in most cases from the accidents of complete retention. If dribbling does not occur spontaneously, the patient is still able to get relief by efforts at bearing-down. There is naturally much dysuria and reflected pain, while in some instances there is a systemic reaction, including fever, anxiety, restlessness, and anasarca. If the case is left to itself the bladder gradually distends until it assumes a prodigious volume. The use of the catheter is quite likely to lead to infection and cystitis. The diagnosis is readily established by palpation and the catheter. The dribbling of retention should not be confounded with true incontinence. The *prognosis* depends upon the character of the relief afforded by the use of the catheter and by attempts to remove the cause. *Treatment:* The prompt and repeated use of the catheter will insure the patient against the immediate unfavorable results of retention. This is offset somewhat by the dangers of catheterization. It may be necessary to introduce the instrument in the genupectoral position. Glass is the best material for the catheter (Part X).

13. Vesical Hemorrhoids.—These, like other local pelvic varicosities occurring during pregnancy, are the result of the general pelvic congestion, and usually first draw attention to the condition on the occurrence of rupture and consequent hematuria. The condition can only be suspected until cystoscopic examination be made.

14. Vesical Calculi.—Vesical calculi have caused vesico-vaginal fistula during labor and a case is recorded in which a stone was found large enough to obstruct delivery.* The induction of labor during the last month of pregnancy may be demanded; this late date being chosen in order that the prognosis for the child may be rendered as favorable as possible.

15. Cystocele.—This may cause a pouching of the anterior vaginal wall, the tumor even passing through the vulva. It has been mistaken for the amniotic sac and punctured. For diagnosis a catheter may be passed into the cystocele and palpated by vaginal touch. For treatment, after the bladder is evacuated, the anterior vaginal wall should be pushed up in order that pressure by the head may be avoided.

* Dakin: "Handbook of Midwifery," page 460.

16. Vesical Neoplasms and Traumatisms.—Carcinoma may occur and be secondary to carcinoma of the cervix. Vesical irritation and hematuria are among the symptoms.

17. Albuminuria.—The subject of albuminuria in the gravid is an extensive one, which is considered under toxemia of pregnancy, eclampsia, etc. It merits some independent consideration as well. Occurring in the first half of pregnancy it must be regarded as of toxic origin, or as suggestive of hepatic insufficiency or renal disease. The so-called functional albuminuria—which is now believed to depend largely upon gastric insufficiency—may be present before conception; but von Rosthorn (Winckel's "Handbuch," 1903) assures us that this condition never becomes aggravated by pregnancy, and that it is not necessary to dissuade women with this anomaly from marriage and conception.

True albuminuria of pregnancy begins, as a rule, not earlier than the twenty-fifth week; and it is of such common occurrence that some regard it as practically the rule. Once believed to be much more common in primigravidæ, it is now thought to occur irrespective of parity. It is probable that a small amount of albumin in the urine may be accounted for by circulatory disturbances alone, and that to be considered evidence of a toxic state, albuminuria must be associated with other phenomena. When the amount is considerable, or when it steadily increases from small beginnings, it naturally suggests both a toxic state and a renal lesion. It by no means follows that the trace of albumin so often found comes directly from the blood, for it may simply be derived from the epithelia and leucocytes which make their appearance in the urine in increasing numbers late in pregnancy. Naturally only traces could be accounted for in this manner.

The fact should be emphasized that waste of albumin is not without significance in pregnancy. Albuminuric women show a distinct tendency to abortion and premature delivery; and while the fetus shows subdevelopment the placenta is increased in size and shows such peculiarities as to be termed the "albuminuric placenta." This subject needs to be studied anew, for it is possible that a certain phase of endometritis gravidarum may account for the entire condition.

18. Polyuria.—Owing to increased tissue change, a moderate increase of the urinary secretion always occurs during pregnancy. Occasionally the increase is excessive. Cases are recorded in which 200 or more ounces (6 liters) in a day were passed. The urine is usually normal in character except for a low specific gravity. The patient suffers from thirst and the annoyance caused by frequent urination. Treatment adapted to cause decrease in the flow of urine is not advisable.

19. Peptonuria.—This is sometimes caused by fetal death and the absorption of proteids (page 272). In other cases no assignable cause can be found.

20. Hematuria.—This is usually due to vesical hemorrhoids, but may occur from other affections of the bladder and kidneys, as acute nephritis or cystitis, calculi, neoplasms, or traumatisms of the bladder. For treatment the pelvic congestion should be relieved by avoiding constipation and tight clothing. Injections of astringent solutions may be tried in bad cases if the symptoms point to the bladder as the seat of the trouble.

21. Glycosuria.—The existence of glycosuria in pregnancy and the puerperium has been known for many years, and in 1877 it was ascertained that puerperal glycosuria was a lactosuria, and thereby related in some manner to the secretion of milk. The glucose which may sometimes appear to indicate a toxemia should not be regarded as necessarily pathological, for if the tests are

of sufficient delicacy this substance may be found in nearly all urine, and must, under these circumstances, be regarded as purely dietetic. This fact was made the basis of Schenck's method of controlling sex of the offspring; since if the normal trace of sugar cannot be made to disappear by diet, the infant will probably be a female. Regarding the high degrees of glycosuria and true diabetes, since these conditions may develop during pregnancy or be present throughout it, the outlook is much the same as in operative surgery, and the greater the degree of glycosuria, the worse the prognosis. Statistics appear to show that labors in these women are quite apt to end unfavorably in one or another way.* The fact that diabetes has been known to set in during pregnancy and disappear spontaneously after delivery would seem to connect such a phenomenon with the special toxemia of pregnancy. Women who have thus recovered have gone through subsequent pregnancies without reappearance of the disease. Other records indicate that a diabetes lighted up in pregnancy may remain permanent. When a diabetic woman becomes pregnant, her disease usually takes a turn for the worse, with a tendency to improve temporarily after confinement. According to Lecorche, true diabetics who become pregnant usually succumb to the disease within a short time after delivery.

22. Lipuria and Chyluria.—These conditions are occasionally noticed. The former is due to the general increase in adipose tissue throughout the body. They are of no special clinical importance.

23. Acetonuria.—The metabolic changes incident to pregnancy would naturally direct one's attention to the index of metabolism, the urine. The significance of acetonuria in general not being well understood, such an investigation as that undertaken by Max Stoltz,† in "Acetonuria in Pregnancy, Childbirth, and Puerperium," is highly welcome. He finds that a slight acetonuria which is physiologically found in pregnant women is not constant but is quite variable. Increased acetonuria is frequently found in the course of pregnancy, lasting for one, two, or three days, without any symptoms of pathological causes. In the majority of cases during child-birth there is increased acetonuria. The longer the labor lasts, the more frequently does acetonuria occur and the more abundant it is. In primiparæ it is more constant and greater than in multiparæ. During the first three days of the puerperium, occasionally during the first four days, it is considerably increased. Less often it appears greatly increased later in the puerperium. The increased acetonuria of the puerperium is, as a rule, closely connected with the same condition during parturition. The influence of the establishment and the continuance of lactation upon this condition requires further investigation. Increased acetonuria in pregnancy and parturition is worthless as an index of the death of the fetus. It is a physiological manifestation, without any pathological significance or cause. It is explained by the alteration in fat metabolism during pregnancy and the succeeding states, and, corresponding to it, is of irregular and transitory duration.

24. Urinary Sediments of Pregnancy.—It is now known that abnormal deposits occur in the urine of the gravida in the latter half of pregnancy in not less than 97 per cent. of all cases. (Fischer, "Arch. f. Gynekol.," xliv.) This appears to result largely from circulatory disturbances which are inseparable from direct and indirect pressure from the enlarging uterus. There is more or less desquamation along the entire urinary tract, as shown by catherisation of the ureters. In the renal epithelia fat droplets may sometimes be seen.

* Matthews Duncan: "Trans. Obstet. Soc. London," 1882.

† "Archiv f. Gyn.," Feb., 1902.

There is always a leucocytosis in the urine of the gravid, and the corpuscles may proceed from the bladder or kidney; in the latter case being accompanied by albuminuria. Erythrocytes and hematoidin crystals are sometimes encountered, and are thought to proceed almost wholly from the ureters unless, of course, nephritis is present. Finally it is not uncommon to find hyaline casts (25 per cent., Fischer), which are by no means necessarily associated with albuminuria. These cylinders are sometimes covered in part by renal epithelial leucocytes, or erythrocytes. Granular casts are present but rarely and are always accompanied by albuminuria.

These sediments are present at first but sparsely, but increase regularly toward term. During labor they attain a maximum, and erythrocytes are then invariably present in large numbers.

XII. DISEASES OF THE ALIMENTARY TRACT.

1. Gingivitis. 2. Dental Caries. 3. Oral Sepsis. 4. Salivation or Ptyalism. 5. Anorexia. 6. Nausea and Vomiting 7. Persistent Vomiting; Hyperemesis Gravidarum. 8. Malacia; Longings. 9. Gastric and Intestinal Indigestion. 10. Consumption. 11. Diarrhea. 12. Hemorrhoids. 13. Jaundice; Icterus Gravidarum. 14. Appendicitis. 15. Tapeworm.

1. Gingivitis.—An inflammation of the gums due to the blood-changes of pregnancy not infrequently occurs during gestation. It usually subsides after the birth of the child, though it may continue throughout lactation. This affection is generally coincident with salivation, although it may occur alone, and is more frequently seen in multigravidæ than in primigravidæ. The gums are swollen and tender and bleed at the slightest touch; they are retracted, leaving the necks of the teeth exposed to all the secretions of the mouth, and as these are frequently very acid, their effect upon the teeth is deleterious. The latter are apt to become loosened, making mastication difficult as well as painful; the rest of the mouth may be involved and the process extend to the pharynx and even to the stomach; the breath has an unpleasant odor. *Treatment:* The teeth should receive the careful attention of a dentist. A good remedy is precipitated chalk pressed between the teeth at bedtime. During the day milk of magnesia may be used repeatedly as a mouth-wash.

2. Dental Caries.—The rapid decay of the teeth seen in many women during pregnancy is not due to the deficiency of lime salts in the blood, as it has never been shown that there is such a deficiency; but it is undoubtedly caused by the acid eructations, vomiting, and secretions, the result of acid dyspepsia of the early months of gestation. I have frequently noted in my private practice that the number of teeth attacked and the rapidity of dental caries were directly proportionate to the frequency, intensity, and persistency of acid dyspepsia with eructations and vomiting. Biro* has shown that mere pregnancy, aside from causing acid dyspepsia, has no effect on the teeth. One of the first duties of the obstetrician toward his patient in pregnancy is to inquire into the condition of the teeth and mouth, and, if necessary, to send the patient to her dentist. Dental caries lapping over into or originating during pregnancy should receive immediate attention. The carious substance should be partly or completely removed, the cavity touched with pure carbolic acid (an alkali), and a temporary gutta-percha filling put in. Severe and painful dental procedures, however, without the use of cocain or nitrous oxide, should be avoided, since they may lead

* "Wien. med. Blätter," 1898.

to abortion. For prevention we have nothing so efficacious as the free use locally of alkalies, such as milk of magnesia, lime-water, or bicarbonate of soda, my preference being for the first. This should be used as a mouth-wash after each meal and at bedtime, care being taken to draw the fluid between the teeth. It may be used oftener when the vomiting of pregnancy is persistent. Small doses of milk of magnesia taken internally will often correct acidity, relieve vomiting, and thus prevent dental caries. In all cases attention must be given to the dyspepsia present.

3. Oral Sepsis.—The mouth should be examined in all cases of fever or septic symptoms occurring during pregnancy or the puerperium, and particularly in instances of persistent nausea and vomiting of pregnancy. Many pregnant women, consciously or unconsciously, have ulceration from caries going on at the root of an old molar, which intermittently discharges a foul pus at the edge of the gums (pyorrhœa alveolaris). Again, the rapid increase in the use of bridges and gold caps over old broken-down fangs is, I am sure, an important factor in oral sepsis. Often we find bone necroses under these caps and bridges, and pus organisms from this source are most virulent. Not only is this local septic condition a cause of stomatitis, but it is, the author feels sure, an important and prevalent cause of gastric disturbances and systemic infection. In one of my cases a second molar, decaying and ulcerating at the roots, was removed under nitrous oxide by Dr. Hasbrouck, of New York, in the middle of gestation; this was followed by a distinct improvement in pronounced gastric disturbances present, and a cessation of symptoms which resembled an atypical form of malarial infection, and which were attributed at the time to imperfect plumbing. In my belief these general phenomena were septic in character. *Treatment:* The source of the pus should be removed, with the use of nitrous oxide if necessary; especially should necrosed and useless fangs be extracted, and proper drainage effected. More attention should be given to oral antisepsis than has hitherto been the custom; caps and bridges should be avoided; all removable mouth plates should be sterilized daily; in cases in which, for any reason, removal of necrosed teeth is not advisable, or the patient refuses to have it done, the stump should be thoroughly touched daily with carbolic acid (1 : 20), and several times a day an antiseptic mouth-wash, such as peroxide of hydrogen (1 : 4), should be used.

4. Salivation or Ptyalism.—This occurs most commonly in the early months of pregnancy, and consists in a profuse secretion of saliva; the patient suffers from a continual dribbling which is very annoying; the condition is due to a neurosis or toxemia. Sometimes the amount of saliva expectorated in twenty-four hours will reach two or more quarts. The general health may even be impaired by this trouble; and in certain instances the affection continues to term, and, very exceptionally, for some months after labor. The danger to the patient lies in the inanition which results from this drain on the system. In Schramm's case the ptyalin was absent, so that the saliva had no digestive properties left. The mucous membrane of the mouth becomes red and swollen; there is no fetor, and this distinguishes the affection from mercurial ptyalism. *Treatment:* Astringent tablets, such as troches of tannic acid, and counterirritation over the parotids are useful; the bromides are most often of service; atropin or belladonna may be tried; careful attention to the general health is necessary.

5. Anorexia.—Complete anorexia sometimes occurs; more commonly there is a disgust for particular kinds of food, rather than absolute anorexia. This condition is apt to manifest itself at either extreme of pregnancy, when the neurotic features are most predominant. Sometimes the patient will not be able

to bear the thought of meat of any kind; again, she can take nothing else but meat. *Treatment:* Tonics and vegetable bitters are useful; the liver and bowels should be carefully regulated, and the patient should be humored as much as possible in the choice of food.

6. Nausea and Vomiting.—(See Toxemia of Pregnancy, page 291.)

7. Pernicious Vomiting; Hyperemesis Gravidarum.—(See Toxemia of Pregnancy, page 291.)

8. Malacia; Longings.—Patients will occasionally show a perverted appetite for unnatural and unheard-of articles of diet. This affection is also designated as *pica*, or more popularly as pining. In very rare cases it may be exaggerated to true insanity. Gentle treatment may have some effect; the mind should be diverted; hygiene, particularly of the alimentary tract, should be carefully looked after, and, if necessary, moral suasion should be tried. Labor terminates these symptoms.

9. Gastric and Intestinal Indigestion.—These affections often occur in pregnancy, especially in primigravidæ. Pyrosis or heartburn is particularly troublesome in the gastric form, enteralgia being most striking in the intestinal disturbance. These discomforts are manifest most often in late pregnancy. *Treatment:* Attention to diet and the relief of constipation may be all that will be necessary. Alkalies are frequently useful in pyrosis. Pepsin, pancreatin, diastase, powdered calumba, the alkaline mineral waters, and an occasional dose of calomel may be symptomatically indicated. In the intestinal indigestion of pregnancy I have obtained good results from a mixture of hydrastis, bicarbonate of potassium, and pancreatin or essence of pepsin (Fairchild).

10. Constipation.—This is a common accompaniment of pregnancy, and is due partly to pressure, but mostly to deficient innervation of the muscular coat of the bowel, causing an exaggeration of the normal intestinal torpidity of women. Women sometimes pass a week or more without defecation, and then copræmic symptoms, such as mental dulness, dizziness, distended veins, and headache, are apt to supervene. The direct mechanical pressure of the enlarging uterus on the intestines has been shown by frozen sections to be almost insignificant. However, the distended anterior abdominal wall is deprived of much of its power as a factor in defecation. Constipation has a tendency to cause hemorrhoids, and may even, by accumulations in the colon, predispose to abortion.

Treatment should be prophylactic, as far as possible; the trouble should be anticipated early in pregnancy by a laxative diet, including fruits, and an abundant quantity of plain water, drunk at bedtime and on rising in the morning. In the curative treatment violent cathartics must be avoided, as they usually exaggerate the condition subsequently, and have been known to interrupt pregnancy. In neglected cases of several days' standing repeated enemata of sweet oil and ox-gall may be necessary to unload the impacted rectum, or even the mechanical use of the spoon, followed by enemata. Ordinarily the best results will be obtained by the use at bedtime of pills containing varying quantities of aloin, cascarin or extract of cascara, extract of belladonna, strychnin, podophyllin, and capsicum. These pills or tablets may be obtained the world over. Experience has taught me that one formula will not be suitable for all; I am, therefore, accustomed to use as many as six different combinations, according to the nature of the case. It will sometimes be necessary to try three or four different formulæ, until a suitable one is found. Extract of cascara sagrada, ½ gr. (0.03); cascara sagrada cordial, one or more teaspoonfuls (4 to 8); fluid

extract of cascara, in increasing doses, after meals or at bedtime; compound licorice powder, capsules, tablets, or pills of inspissated ox-gall, 2 grains (0.12); extractum pancreatis, 2 grains (0.12); and extract nux vomica, $\frac{1}{4}$ grain (0.015); after meals and at bedtime; small doses of Apenta, Birmenstarff, Marienbad, Hunyadi, Friedrichshalle, Villacabras, or Rubinat-Condal waters, an hour before breakfast, are all reliable remedies; but a suitable one for each individual case must be chosen. For years I have been in the habit of using combinations of these waters, as Marienbad and Birmenstarff, equal parts; Birmenstarff half a tumblerful and Villacabras one or two tablespoonfuls; Friedrichshalle half a glass, and one or two tablespoonfuls of Villacabras, or four tablespoonfuls of Rubinat water. Combinations of Apenta and the stronger purgative waters can be made in the same way. I have found Friedrichshalle water, one-third of a tumblerful, and Saratoga Hawthorne water two-thirds, a pleasant and valuable laxative and a marked diuretic.

Enemata of plain soapsuds, and of oil, glycerin, and ox-gall, as well as laxative suppositories of glycerin and gluten, are occasionally useful, but should not be used continuously for fear of irritating the rectum. Various pastes containing figs are often useful. A good laxative fig paste is made from one pound of figs, two ounces of senna, one ounce of coriander seed, and sugar enough to make a paste. Small quantities of this paste may be taken at bedtime, or even after meals.

11. **Diarrhea.**—This is not common, but occasionally occurs as the result of irritation from pressure, and from errors in diet. If severe, it may cause an interruption of pregnancy, hence it is more serious than constipation, and when it amounts to dysentery it is most unfavorable. The treatment consists in the use of astringents, such as tannin or aromatic sulphuric acid, combinations of opium, bismuth, chalk, and zinc, and, in neurotic subjects, the administration of nerve sedatives and bromides.

12. **Hemorrhoids** are common, on account of the general pelvic congestion incident to pregnancy, and the direct effect upon the circulation of the uterine pressure. They are often due to constipation and straining. Very rarely are the hemorrhoids of pregnancy the cause of severe hemorrhage, anal fissures, and fistulæ; nevertheless they cause intense discomfort and even suffering. *Treatment:* Operations are to be avoided, as likely to induce premature labor. The recumbent position, and the frequent assumption of the knee-chest position, will be useful; constipation should be avoided; benefit may be derived from the use of astringent and anodyne ointments and suppositories; *e. g.*, unguentum gallæ, unguentum stramonii, equal parts; opium suppositories; compound ointment of galls. The application of fluid extract of witch-hazel upon a compress, and this in turn covered with an ice-bladder, will often afford relief. For the constipation, sulphur, alone or in combination with aloin and extract of belladonna, is valuable.

13. **Jaundice; Icterus Gravidarum.**—(See Toxemia of Pregnancy, page 291.)

14. **Appendicitis.**—While this condition is at present regarded as rare in pregnancy, it is probable that its frequency will become much greater, since the disease itself seems to be on the increase and should certainly be favored by the fact that pregnancy itself appears to be passing more and more into an autotoxic state or states.

One aspect of the autointoxication of pregnancy is intestinal torpor, fecal stagnation, stercoremia, etc.—conditions which tend to involve the appendix directly. An inflamed appendix occurring in pregnancy may set up a salpingitis, and thereby pave the way for certain forms of sepsis following labor.

Appendicitis in the pregnant woman when of mild degree might readily be overlooked by confounding it with some other local affection. In a suspected case the history of a prior attack is of great value, and with such a history some obstetricians do not hesitate to operate at once; others choose an interval operation after delivery.

Aside from the few preceding considerations, appendicitis in the pregnant presents no differences from the same affection in the non-pregnant.

15. Tapeworm.—Much distress and possibly interruption of pregnancy may be caused by tapeworm during pregnancy. I have been confronted with the problem of treatment in cases of intense abdominal distress and insomnia, as anthelmintics followed by the usual castor-oil may interrupt pregnancy. I have observed decided symptoms of threatened miscarriage from their use. Broadly speaking, we should wait until the thirty-sixth week before resorting to treatment. Should the health of the patient be seriously compromised by the presence of the tapeworm, we may be compelled to resort to anthelmintic treatment earlier, in spite of the risk of miscarriage.

XIII. DISEASES OF THE CIRCULATORY SYSTEM.

1. Acute Endocarditis. 2. Chronic Endocarditis. 3. Affections of the Heart Muscle. 4. Varicosities. 5. Aneurism. 6. Palpitation. 7. Syncope. 8. Hydræmia. 9. Pernicious Anemia. 10. Exophthalmic Goiter.

1. Acute Endocarditis.—This affection not only has an injurious influence upon pregnancy, but it is also apt itself to become extremely grave. Pulmonary congestion is sure to exist from the impeded action of the heart. Œdema of the lungs causes the blood to be dammed back on the heart, and there result cardiac failure and fatal syncope. The most usual time for the occurrence of this accident is during or just after the birth of the child, and it is caused by the extra strain on the heart, coincident with the circulatory changes due to the lessened intra-abdominal pressure. Regarding *treatment*, induced labor will be demanded with the rapid emptying of the uterus after dilatation, nitrous oxide or ether being used if compensation is absent. Digitalis is often useful in the first stage of labor, and forceps always in the second. Moderate hemorrhage in the third stage, or just after it, relieves the symptoms of cardiac embarrassment. Nitrite of amyl has proved useful after labor.

2. Chronic Endocarditis.—This is often followed by a fatal termination, due to the fact that the hypertrophy which already exists, and has been sufficient to make up for the strain of pre-existing valvular lesions, is no longer able to meet the extra demands of pregnancy. One great danger in all cardiac cases, especially those with acute symptoms, is embolism. Pulmonary troubles are also apt to supervene in the last half of pregnancy, from exposure to cold or exertion. Pulmonary congestion and œdema may occur with fatal result. Valvular disease may prove a very unfavorable complication, and this is largely due to the same reasons which render the prognosis so unfavorable in pneumonia, and also to increased pressure in the blood-vessels, which is incident to pregnancy and labor. Death is often the result in severe mitral disease, the heart showing its weakness especially after expulsion of the child or placenta. The *prognosis* is unfavorable for both mother and child, although with proper care many cases will terminate favorably; placental apoplexy and abortion are common. Mitral lesions, especially mitral stenosis, are particularly to be dreaded.

The *treatment* is symptomatic as regards the cardiac affection. The avoidance of overexertion and excitement is of the highest importance, and the hygiene and nutrition of the patient should be carefully guarded. The induction of labor must be considered if the symptoms become very grave. Inhalations of nitrite of amyl may be of service in cases of dyspnea and extreme high tension; stimulants are to be given only if indicated. In cases of great embarrassment of the right heart, allowing the uterus to relax and bleed during the third stage will be beneficial. Anesthetics should be used with caution, ether being preferred. For obvious reasons the use of ergot is not advisable in cases with a tendency to contraction of the arterioles. Syncope should be guarded against by the application of the abdominal binder before delivery, which is gradually tightened during the emptying of the uterus. I have found careful attention to nutrition and the secretions, enforced rest with massage, and the prolonged and free use of strychnin of great help in bringing a case of chronic valvular disease to the period of viability, or even to full term. During labor I use ether, and hasten the dilatation as much as possible by bimanual stretching, giving digitalis if indicated, strychnin always, and I always shorten the second stage with forceps. Venesection is often useful.

FIG. 472.—VARICOSE ENLARGEMENT OF THE LEFT SAPHENOUS VEIN IN A PREGNANT WOMAN.

3. Affections of the Heart Muscle.—There can be no doubt that in cases of valvular lesions the hypertrophy, which before pregnancy was sufficient for compensation, may become insufficient in view of the increased demand, and thus may lead to serious symptoms. Fatty degeneration may occur as the result of the toxemia of renal disease, or of septic infection; brown atrophy has been observed in a few instances. The existence of myocarditis should cause grave apprehensions, because the heart is hindered from adequately developing to meet the demands made on it by the valvular lesions added to pregnancy.

4. Varicosities.—Varicose veins, especially of the thighs and lower gluteal region, are very common (Fig. 472). Those of the vulva, vagina, and rectum have already been noted (Fig. 466). Varicosities also occur within the pelvis, especially in the broad ligaments, and by their rupture may cause pelvic hematocele; the occurrence of hematuria from the rupture of varicosities of the bladder has been noted. The chief cause is the obstruction to the return circulation, by the pressure of the gravid uterus. Predisposing causes are the increased amount of blood in the circulation, and changes in the walls of the vessels, such changes being favored by renal disease and hydræmia. Multigravidæ are more often subject to this trouble than are primigravidæ. The saphenous vein is always the first vessel affected. Pain, especially upon standing or walking, and with an itching sensation over the dilated vein, are common symptoms; sensations of intrapelvic weight and pressure may occur. The *prognosis* is good with proper treatment,

but the possible occurrence of rupture should not be forgotten; such an accident may be followed by most alarming hemorrhage. Thrombosis and phlebitis are possible complications.

Treatment.—The patient and friends should be warned of the possibility of rupture, and should be furnished with a compress and bandage, instructed in their use, and how, in case of hemorrhage, the limb should be elevated. Constipation should be avoided, and the patient should spend a good deal of the time in the recumbent position, with hips and legs elevated. Varicosities of the lower extremities should be treated by the use of properly fitting elastic stockings, or carefully applied bandages. Varicosities of the vulva should be supported by a pad and a T-bandage. In all cases, too much standing or walking should be avoided, and there should be no constriction about the waist. An abdominal supporter may help to prevent excessive uterine pressure (Fig. 228).

5. Aneurism.—This is not common during pregnancy, but is of clinical importance, because of the danger of rupture from the straining efforts of the second stage. The careful administration of an anesthetic, and the termination of labor as soon as is consistent with due regard to the interest of the mother, are advisable.

6. Palpitation.—This is a frequent occurrence. It may be of neurotic origin or reflex, from upward pressure of the uterus on the diaphragm; in many cases, no doubt, both elements contribute to the causation; in the absence of organic disease it is not usually of great importance. *Treatment:* Nerve sedatives may at times be indicated, but as a rule it is better to attend to the general hygiene of the patient and the removal of reflex causes—*e. g.*, constipation. Moderate exercise in the open air is beneficial; causes of excitement and worry should be removed if possible. Should the condition of high arterial tension exist, profuse watery stools produced by the use of calomel and salines may be required, and rest with careful diet insisted upon. If the trouble is the result of mechanical difficulties in the last part of pregnancy, hygienic measures, together with antispasmodics, may give some relief, but only when the uterus begins to sink will permanent relief occur.

7. Syncope.—A special syncope of pregnancy is mentioned by some writers as a manifestation of hysteria. Its consideration belongs under the latter head.

8. Hydræmia ; Serous Cachexia ; Serous Plethora.—An increased fluidity of the blood was formerly supposed to exist during the whole of pregnancy. Recent investigations have tended to show that in the latter months the proportion of hemoglobin and the number of red corpuscles are increased. There is no doubt, however, that hydræmia does exist in a large proportion of cases, especially in ill-nourished subjects, in consequence of the increased demands upon the maternal circulation. Not uncommonly in hydræmia there is swelling of the lower extremities extending upward even to the lower segment of the uterus. If there are no kidney complications, danger need not be anticipated, but the discomfort caused is excessive. Nervous manifestations are common; there is a sense of fulness in the vessels, with disagreeable pulsation of the arteries; flashes of heat, imperfect vision, and dyspnea are present; dull aching in the sacral region, and a diminution of the fetal movements, and even toxic symptoms may occur. The *diagnosis* is clear from the history of the case and from the blood-examination. The latter reveals an abnormal amount of serum, a decreased number of red blood-cells, less albumin and iron, and increased fibrin. The blood, after being taken from the vessels, forms a clot with abundant serum floating about it, closely resembling that of chlorosis. The whole amount of fluid is often much more than normal. The *prognosis* is generally good. The symptoms

quickly subside after the child is born, and prematurely induced labor is rarely necessary. The *treatment* consists in careful attention to the secretions; the persistent administration of some readily assimilated preparation of iron, as the peptomanganate or albuminate of iron, with cod-liver oil; careful attention to the diet; forced feeding if necessary; massage, with a change of air and environment.

9. Pernicious Anemia.—This condition is also known as progressive anemia; it is of rare occurrence, and its etiology is obscure. It may be due to a previous anemia or chlorosis, from whatever cause; and when once established, there is a continuous progression till death either threatens or occurs; no serous plethora, as in hydræmia, takes place, and there is only a slight œdema. Examination of the blood shows slight hydræmia, and a diminution of albumin and of the number of red blood-corpuscles. There are progressive pallor and emaciation, with exhaustion; the symptoms resembling those of a severe attack of chlorosis. Loss of appetite, hemorrhages from mucous surfaces, and attacks of vertigo and faintness are common. The nervous system is not well balanced; profound inanition may ensue, and the patient may die comatose. The ovum may or may not be prematurely expelled. The *diagnosis* is simple and the *prognosis* bad. Everything possible should be done to improve nutrition; tonics, especially iron, should be used, a reliable preparation of the peptonate or albuminate being usually preferable; arsenic is usually valuable; change of air and scene may be of great service; the inhalation of oxygen is highly recommended; correction of the gastro-intestinal catarrh which frequently coexists is most important; the induction of abortion may become necessary.

10. Exophthalmic Goitre.—In 1895 Theilhaber* collected the reported material on the relationship of Basedow's disease and pregnancy, and the connection between the same affection and the puerperium and lactation. In pregnancy a minority of cases of coincidence of the two conditions shows that the disease was cured or improved by gestation, while in an excessive majority the disease was made worse. Theilhaber sees in the relationship between Basedow's disease and pregnancy a parallel to the frequent occurrence of neuroses during the same condition (neuralgia, epilepsy, chorea, etc.). The relation between Basedow's disease and the puerperium is as inconstant as the above. It has frequently been observed that the disease developed during the puerperium and then subsided, to reappear at a subsequent puerperium; and something of the same nature has been observed in connection with lactation. Kleinwächter claimed that the atrophy of the uterus often associated with Basedow's disease was of a nature to exclude the possibility of gestation; but in a patient of Theilhaber the woman conceived after years of uterine atrophy and amenorrhea. It is best to dissuade girls with Basedow's disease from marriage. Those already married should be forbidden to conceive, for the good reason that both gravidity and the puerperium frequently aggravate the disease greatly, and that the offspring of such women are often highly neuropathic. On the other hand, if pregnancy is already established, the prognosis is not sufficiently grave to indicate its interruption unless the cardiac musculature is seriously compromised. In cases of child-birth in these goitre subjects prolonged lactation is contraindicated.

* "Arch. f. Gynäkol.," 1895.

XIV. DISEASES OF THE RESPIRATORY SYSTEM.

1. Hyperosmia. 2. Bronchitis. 3. Pneumonia. 4. Emphysema. 5. Pleurisy. 6. Hemoptysis. 7. Pulmonary Tuberculosis. 8. Acute Miliary Tuberculosis. 9. Dyspnea of Pregnancy. 10. Nervous and Spasmodic Cough. 11. Asthma.

1. Hyperosmia.—Pregnant women of nervous temperament are sometimes annoyed by an abnormal development of the sense of smell. Unpleasant odors should be avoided as far as possible, and pleasing ones substituted, as the condition may predispose to nausea and vomiting, and even be an important factor in the production of the pernicious vomiting of pregnancy.

2. **Bronchitis.**—During pregnancy this is of no special significance, except that violent coughing may induce abortion. In all respiratory diseases, however, it should be remembered that the hydræmia of pregnancy predisposes to pulmonary œdema.

3. **Pneumonia.**—(See Infectious Diseases.)

4. **Emphysema.**—This frequently occurs in an aggravated form, and may cause abortion, from the retention of carbonic acid gas in the blood; the influence of this gas in causing uterine contractions is noted in connection with the etiology of abortion. Symptomatic treatment, with counterirritation of the chest, is indicated. It is possible that the inhalation of oxygen, from the relief it affords, may tend to prevent abortion. Careful watch must be kept for symptoms of weakening heart, and should they ensue artificial labor may be demanded.

5. Pleurisy with effusion, owing to the diminished breathing space, and the additional work thrown upon the heart, is a dangerous complication of pregnancy. If the effusion becomes purulent (empyema), the danger is manifestly increased. If the condition can be relieved by the evacuation of fluid, by aspiration or otherwise, the procedure is imperatively indicated; otherwise the treatment is symptomatic.

6. Hemoptysis may occur, in connection with overaction of the heart, during the last few months of pregnancy, without organic pulmonary disease, and is most common in women of highly nervous temperament. The treatment should include absolute rest and quiet, and the use of sedatives, particularly the bromides.

7. Tuberculosis and Pregnancy.—The subject of the relationship between tuberculosis and pregnancy has recently attained an increased degree of importance, through the agitation in favor of the justification of abortion in the tuberculous pregnant woman. A sort of traditional view still exists in the minds of some medical men and laymen, that pregnancy may sometimes arrest the development of consumption.

Pregnancy a Predisposing Cause of Tuberculosis.—Statistics appear to show, according to Lancereaux, that a considerable number of cases of tuberculosis develop solely as a result of pregnancy. The morbific action of the bacillus is not discredited by this statement, which simply means that the woman who became tuberculous, had no family history of the disease, was not of the scrofulous or tuberculous habit, had never been exposed to the hazard of contagion, and was living at the time of the infection in a good sanitary environment. Assuming, as Lancereaux does, that the bacillus is omnipresent, we must conclude that pregnancy by itself can render a healthy individual "tuberculizable." If pregnancy can thus affect the healthy, how much more likely would it be for the disease to assert itself in a woman who is a fit subject for it, or in one who is

actually consumptive? In the former class are so-called "candidates for tuberculosis," who have a family history of the disease, of much significance under these circumstances; one should strongly dissuade girls with tuberculous history and antecedents from early marriage, fearing that rapid child-bearing will infallibly light up the dreaded malady. What has been said of the "candidates for tuberculosis" applies with the same or greater force in the case of so-called latent tuberculosis, and of apparent recovery from the disease. It must not be understood that exceptions may not occur, and that tuberculous suspects necessarily become phthisical after pregnancy. The influence of pregnancy, whether single or repeated, upon such women represents a tendency rather than a law, but the physician's responsibility is not lessened by this fact, and he must necessarily be something of an alarmist, in order to advise his patients upon the safe side. The circumstances and environment of the woman, and the general prognosis of pregnancy, aside from the question of tuberculosis, should have great significance in the matter of forbidding or interrupting a pregnancy. In a case of uncontrollable vomiting, for example, the fact that the woman is a tuberculous suspect would have much weight in influencing the physician to interrupt the pregnancy. Future generations must decide as to whether pregnancy in the tuberculous woman should be interrupted as a routine procedure. Present sentiment is beginning to dissuade such women from marriage, not less for their own benefit than for the sake of posterity, and all organized movements which are seeking to eradicate tuberculosis from the world lay much stress on discouraging marriage in tuberculous suspects. As long as this view prevails, there will necessarily be some justification for interrupting pregnancy already under way.

On the other hand, it is claimed that incipient phthisis is no longer a fatal affection, and that two-thirds or more of such cases may be cured, or at least brought to a standstill. If this view be accepted, we have no statistical evidence to show that consumption which develops during pregnancy may be cured or arrested. If the disease develops early in pregnancy, the woman must go on for a number of months before she can become a fit subject for treatment, and this delay would of course militate greatly against her chances of recovery. Sanatoria for consumptives do not care to admit pregnant women, and this prohibition is equivalent to ranking them as incurable. It cannot be denied that such a custom as the induction of abortion, in mere tuberculous suspects, might readily become a source of abuse, by furnishing a pretext for malpractice; but, at the same time, the fact that a candidate for tuberculosis runs a very great risk of becoming a consumptive through child-birth is a most stubborn one, and when, in addition to becoming a consumptive herself, she also brings into the world an individual who is likely to become tuberculous, it readily becomes apparent that the question of the propriety of therapeutic abortion is bound to become an issue in the future, in the practice of obstetrics.

Pregnancy and Actual Tuberculosis.—As a general rule, gestation exerts a distinctly unfavorable influence upon the disease. The presence of the gravid uterus interferes with respiration and the aeration of the blood, while the nausea and vomiting of pregnancy tend to interfere with assimilation. Despite the fact that a pregnancy is often sufficient to bring about tuberculosis, it cannot be said that an incipient case of the latter is much accelerated by one parturition. As a general rule, it may be stated that the more advanced the pulmonary mischief, the greater the untoward effects of child-birth. Generally speaking, the ill effects of pregnancy are not apparent during the very first months, and some observers regard the fifth month as the period at which the course of the disease is seen to be modified by the woman's condition.

However, the danger to the woman is present not alone through the course of the pregnancy, but in the puerperium as well. A tuberculous woman may go through gestation with no undue acceleration of her malady, only to succumb, after delivery, to acute general tuberculosis or acute tuberculous pneumonia.

Some forms of pulmonary tuberculosis are much less influenced by pregnancy than others, and it is generally held that the so-called *fibroid phthisis* is hardly modified at all, either during gestation or after delivery. This important fact should be borne in mind in practice, because a woman with fibroid phthisis is probably capable of child-bearing. In sharply *localized tuberculosis* the effect of pregnancy by itself does not appear to be unfavorable, and it is even claimed that the woman with such a lesion is better during gestation. The efforts of the lungs, cramped as they are by the gravid uterus, to obtain oxygen constitute a species of pulmonary gymnastics, and, as a result, the tuberculous focus does not increase in size. But the situation may change immediately after delivery. The great strain of labor appears to mobilize the bacillus. The loss of blood, and the shock and fatigue, lower the resistance. The stimulus to forced inspiration is no longer present. Under all these circumstances the local process may suddenly increase, and an acute infection of the lung tissue, or generalization of the tuberculous disease, may occur. The claims made by Pinard and other observers, that phthisis may undergo spontaneous resolution during pregnancy, may possibly rest upon an erroneous interpretation of facts, and in any case such a sequence must be very rare. If spontaneous recovery does occur, it is probably in cases of single and sharply circumscribed foci of disease.

Obstetric treatment has now come to be regarded as the proper course, theoretically at least, but meets with considerable opposition and even condemnation from conservative sources. Bossi, who has practised this form of intervention for ten years, has had only about twenty cases to his credit; whence it is to be inferred that the necessity for intervention does not arise so often as one would naturally suppose. Results appear to show that when done under favorable circumstances —general condition fairly good, pregnancy not very far advanced—intervention holds the disease in check to a decided extent. While these women often bear healthy and well-nourished children, a comparison of the issue of phthisical individuals with those of healthy stock will show, on the part of the former, an inferiority in size and weight, and a greater vulnerability and mortality early in life; and all this irrespective of the prospect of developing some tuberculous disease. Tuberculous pregnant women, also, show no little tendency to abort.

8. Acute miliary tuberculosis occurring during pregnancy is a rapidly fatal disease and is frequently mistaken for septic infection.

9. Dyspnea of Pregnancy.—This condition is marked by paroxysms resembling those of spasmodic asthma, and occurs most frequently in patients of nervous temperament. Dyspnea from purely mechanical causes, such as upward pressure upon the diaphragm, frequently occurs in the later months of pregnancy, and can best be relieved by loose clothing and the avoidance of constipation. It usually disappears spontaneously with the descent of the uterus, which takes place at the onset of the preparatory stage of labor about two weeks before term. Antispasmodics and nerve sedatives, and in severe cases the inhalation of oxygen, are useful.

10. Nervous and Spasmodic Cough.—Coughing of reflex origin and without organic change in the respiratory tract sometimes occurs in pregnant women, especially those of nervous temperament. The paroxysms may be so severe as to induce abortion. It is best treated by nerve sedatives, such as the bromides, chloral, valerian, and asafetida, and by the removal of the reflex causes; *i. e.*,

constipation, granulations or erosions of the cervix. In a severe case which resisted all other treatment, I obtained a cure at the sixth month by curetting away granulations from the vaginal portion of the cervix and cervical canal, and touching all raw surfaces thus produced with pure carbolic acid. Pregnancy was not in any way interfered with.

11. **Asthma.**—In asthmatic subjects the paroxysms are exceptionally severe during pregnancy, and demand the same treatment as in the non-pregnant state, oxygen being of great value. Certain women have asthma only in pregnancy, and the appearance of a paroxysm then becomes evidence of the patient's condition. The general prognosis is somewhat unfavorable for mother and child. Fetal and maternal death have occurred as a direct result of asthma, and therapeutic abortion is sometimes required.*

XV. DISEASES OF THE NERVOUS SYSTEM.

1. Cerebral Disease. 2. Gestational Melancholia, Mania, and Dementia. 3. Vertigo and Syncope. 4. Insomnia. 5. Gestational Paralysis. 6. Gestational Neuralgias. 7. Neuroses.

1. **Cerebral Disease.**—Apoplexy has little influence upon the course of either gestation or labor. Inflammatory diseases are rare and accidental, and their influence upon the course of pregnancy is slight, except in the case of cerebrospinal meningitis; since this latter is infectious, it has an effect upon pregnancy similar to other infectious fevers.

2. **Gestational Melancholia, Mania, and Dementia.**—Insanity rarely has its origin during pregnancy, but may occur and present the types of melancholia, mania, or dementia, the most common type being melancholia with a tendency to self-destruction. This rarely appears until the second third of gestation, and is most common in elderly primigravidæ, especially the unmarried. The causes are pre-existence or predisposition, excessive fright, and prolonged anxiety.

Maternity Insanity in General.—The term puerperal insanity has been generally used in such a sense as to comprise any psychical disturbances which antedate or follow the puerperium, within certain limits. This notion, according to the alienists, is loose and unscientific. The term puerperal insanity should be restricted to manifestations which develop within from four to six weeks after labor, or, in other words, during the period of the lochial discharge. The complete relationship between child-bearing and insanity should be regarded as follows: (1) Course of pregnancy, etc., in the known insane. (2) Insanity of pregnancy. (3) Insanity of the puerperium. (4) Insanity following the puerperium (lactation insanity). (5) To these might be added a fifth type occurring during the act of labor, from the high degree of suffering—insanity (delirium) during labor. In regard to the frequency of these types of insanity, it is claimed by alienists that some 10 per cent. or 15 per cent. of all the female insane who require asylum treatment derive their condition in some way from maternity. According to Abt, if 15 per cent. of insanity is due to maternity, the individual frequency would be as follows: insanity of pregnancy, 2 per cent.; insanity of puerperium, 9 per cent.; insanity of lactation, 4 per cent. These figures, however, have a limited value, for many cases of maternity insanity are so mild and transient that no incarceration is required. It appears safe to say that puerperal insanity, in the narrower sense, is the prevalent form, a fact not without significance in connection with the theory that there is some relationship between this type of psychosis and sepsis.

General Etiology of Maternity Insanity.—Regarded independently of the particular phase of these psychoses, the chief etiological element is doubtless heredity; the proportion of such cases amounting to not less than one-half. In this connection, acquired insanity must also be mentioned as a factor. This condition may develop in those of sound heredity, as a result of acute infectious diseases, violent mental emotions, acute physical overstrain, etc.

General Symptomatology.—This subject should likewise be considered without regard to

* Audebert: Paris Internat. Congress, 1900.

any individual phase of maternity insanity. The symptoms are present in great variety, and all the familiar types of insanity are found within the domain of our present subject. Insanity of the depressive type, including melancholia, hypochondria, and imaginary fears, is sufficiently well represented. The melancholic type frequently exhibits a religious color, expressed by self-reproach, etc. The opposite type of mania is also common, with its exaltation, and increased bodily and mental activity. The expression of the latter may be harmless, consisting in more pronounced eccentricity of various kinds; but it is also often violent, so that restraint becomes necessary. Formerly comprised under mania, but now placed in a special category, is the hallucinatory type. Here there is neither exaltation nor depression, but the patient is simply deceived by her perceptive faculties. The state is therefore one of extreme confusion. Unrecognized or improperly treated, this type of insanity might become coequal in its results with mania. The impulses of the victim of maternity insanity to destroy herself, her children, or others, are now placed under the head of imperative conceptions, not necessarily connected or associated with any of the basic types of insanity. These phenomena are said to be noted particularly when an inherited taint is present, and often they are the first expression of such inheritance. The further discussion of these insanities is continued under the special forms, and they are once more brought together under the head of treatment.

Etiology.—Gestation may either awaken a hereditary taint of insanity, or the psychosis may develop *de novo*. In the latter case the resulting mental state may be regarded as an exaggeration of the disturbances of psychical equilibrium, so common in pregnancy, and in connection with menstruation, especially at the time of the establishment of that function. This type of pregnancy psychosis, then, is the least removed from the physiological status. The disturbed psychical and nervous equilibrium so common in pregnancy would, in itself, occurring apart from that condition, constitute a mild type of psychopathy and neuropathy. We have only to call attention to the unnatural cravings, the blunting and perversion of taste and smell, the preternaturally acute sight and hearing, the remarkable changes in disposition, amounting almost to a reversal of temperament and transformation of character, etc. This type of insanity often appears to have a physical basis, and to stand in close relationship with anomalies of circulation, as shown by the very commonly encountered attacks of vertigo and fainting. Aside from the general causal factors already enumerated, a special factor is found, in the case of pregnancy insanity, in the shock and perturbation induced by the realization of the fact that conception has occurred. This factor obtains chiefly in the unmarried, and in married women who, from any reason, can ill afford to submit to pregnancy. Death of a near relative during pregnancy may have a similar effect.

Symptoms.—Since the eccentricities of pregnant women are commonly understood, the borderland of insanity is frequently overlooked, and opportunities for arresting the condition are consequently forfeited. An act of violence of some sort is the first intimation of the true state of the woman's mind. Many of the milder cases are so slight in degree, and of so short a duration, that they pass unrecognized, and thus help to invalidate the statistics of frequency and severity. As a rule, the character of the psychoses of the early months of pregnancy is of the depressive type; and, generally speaking, psychoses which supervene early in pregnancy tend to become worse with the aggravation of the physical conditions. Further, the numerous severe physical disturbances and diseases which may develop as pregnancy advances have a distinct tendency to aggravate the psychosis, causing it to pass into a more severe and pernicious type. Psychoses of pregnancy are prone to be continued after delivery; a tendency which illustrates the futility of bringing on abortion under the circumstances. Imperative conceptions are prone to supervene during pregnancy, and they should be sharply watched for, in all pregnant women of psychopathic or degenerate stock. These conceptions, held under control by the will before pregnancy, begin at this period to be irresistible. Many of the morbid "phobias," so common in neuras-

thenia, are also encountered under these circumstances for the first time. This sudden impairment of mental equilibrium appears to be due in many cases to the presence of vomiting, vertigo, and the like. The impulses to homicidal or suicidal violence, in the case of these women, often comes from the sight of a knife or other lethal weapon; or of an open window, etc. In some cases the women themselves confess to the presence of these impulses, while they are still able to master them.

Treatment.—The keynote of successful treatment lies in early recognition of the psychosis. Prophylactic and general regimen comprises sufficient feeding, together with proper attention to all existing physical disorders. When the diagnosis is made, an alienist should be summoned in consultation. Hypnotics should be promptly administered, in the hope of procuring sleep and of controlling the attack. When the general practitioner is obliged to depend upon himself, no alienist or asylum being available, he can but carry out three general principles, without reference to the considerations which attend a nice diagnosis. The patient must be (1) nourished, she must be made to (2) sleep, and finally she must be (3) prevented from inflicting injury upon herself, her child, or others. She should be kept upon the ground floor of the house, and all lethal weapons, drugs, chemicals, etc., kept out of reach. She should be kept in bed, and the bedding searched twice daily for secreted articles, which might be used with suicidal intent. The services of a good nurse are all-important. To restrain motor excitement, and thereby limit the danger of suicide, opiates are indicated, and in high degrees, morphin and hyoscin hypodermically. To secure sleep all external conditions must be made as favorable as possible, after which any good hypnotic, such as trional or chloralamid, is indicated. If the patient will eat, she should be fed freely with simple, nutritious articles and weighed frequently. If food is refused, the stomach-tube must be employed.

Various important questions arise in connection with the management of this affection. (1) *Asylum treatment:* While indicated in theory, this resource is directly contraindicated in practice, for the chances are that the patient will quickly recover and will never forgive her medical attendant for the stigma brought upon her (as she believes) by incarceration in an institution. The patient should instead have a trained attendant, and convalescence may be hastened by travel. (2) *Interruption of pregnancy:* This is never indicated, for the very good reason that it does not restore the patient's mind to the natural state. (3) *Lactation:* The patient should never nurse her child and the secretion of milk should be suppressed as soon as possible. (4) *The element of sepsis:* The possibility that puerperal mania may have a septic element should be utilized in every possible way in the management of a case. The patient should have her parturient tract thoroughly examined.

3. Vertigo.—We often observe a dizziness in highly nervous and hysterical women, independent of the toxemia of pregnancy. It must be remembered that an exaggeration of the usual hydræmia and anemia of gestation is often the real underlying cause, and can be relieved by attention to the blood conditions present.

4. Insomnia.—Insomnia may occur with circulatory changes, or independent of them, due to the toxemia of pregnancy. When the former is the cause, the treatment consists in cathartics, diuretics, and diaphoretics. In other cases it is necessary carefully to regulate the diet, and to use nerve sedatives or antispasmodics, such as the bromides, sulphonal, camphor, valerian, and asafetida, care being taken to prevent a drug habit.

5. Gestational Paralyses.—Paralyses in pregnancy are sometimes incorrectly termed puerperal paralyses. The nerves of special sense, or the facial nerves, may be affected, or hemiplegia or paraplegia may occur. Paralyses of the nerves of special sense may result in amaurosis or deafness, partial or complete. In the case of amaurosis, kidney insufficiency should always be suspected. Anemia of the retina may be the cause, and if injury to the latter has not occurred, the premature interruption of pregnancy will result in a cure. Deafness is a rare and temporary condition, and may be either unilateral or bilateral; it may or may not be due to renal insufficiency. Facial paralysis is extremely rare, and is usually the result of profound anemia. Hemiplegia is not uncommon in pregnancy; it may be caused by cerebral hemorrhage or anemia, and does not necessarily interfere with pregnancy or parturition. Paraplegia may be the result of a spinal disease, or of pressure upon the pelvic nerves by the fetal head; the loss of voluntary motion thus produced does not necessarily interfere with pregnancy or labor. Both these conditions may demand the premature interruption of pregnancy, in addition to the use of strychnin, faradization of the affected limbs, and iron. Both hemiplegia and paraplegia are apt to disappear in the puerperium.

6. Gestational Neuralgias.—Neuralgic pains in various parts of the body, the uterus not excepted, are common. Toothache is often met with, and may be of functional or organic origin (see page 321). Neuralgias of the lumbar and recti muscles are also common, the latter being due to excessive stretching; sciatica often occurs in the latter part of gestation, as a result of pressure. Headache, when present, should always make us suspicious of renal insufficiency, as should localized neuralgic pains in the head, face, or breast, which are often symptoms of advanced renal disease in pregnancy.

The treatment consists in careful attention to the excretions, especially those of the bowels and kidneys, and in the use of external and internal palliative measures, such as sedative applications, nerve sedatives, and antispasmodics.

7. Neuroses.—*Hysteria* is more or less common in all pregnant women. The existence of pregnancy renders the mental balance of the woman unstable, and an hysterical attack may be precipitated on the slightest occasion. True insanity has developed as a sequela. Syncopal attacks and hyperemesis are both regarded as of hysterical origin in many cases. The treatment is that of hysteria in general. Moral suasion is far more effective than are drugs.

Epilepsy is a rare complication, because epileptics are usually sterile, and if gestation does occur, are often free from an attack during pregnancy, the disease returning in the lying-in state. It may be confounded with an eclamptic attack (see Eclampsia). Children born of epileptics usually die of congenital epilepsy when quite young.

Chorea in its milder grades is not uncommon; the causes being chlorosis, rheumatism, and heredity. Sixty per cent. of the cases occur in primigravidæ. It usually appears in the first third of gestation, and shows a tendency to persist; it is observed only during the waking hours, but if it is severe and persistent, interruption of pregnancy occurs. The maternal mortality is as high as 30 per cent. Gestational insanity is often a sequela. The causes of death are muscular exhaustion, heart failure, insanity, or the sequelæ of an interrupted pregnancy. The treatment in the milder cases consists of arsenic, given to the physiological point, iron, good hygiene, and carefully regulated diet. Severe cases, with tetany as a complication, may require anesthesia. The induction of premature labor usually results in a spontaneous cure.

XVI. INFECTIOUS DISEASES.

1. Variola. 2. Scarlatina. 3. Measles. 4. Typhoid. 5. Typhus. 6. Erysipelas. 7. Malaria. 8. Pneumonia. 9. Syphilis.

These affections are also considered fully under the pathology of the fetus (page 255). In the present connection they are briefly treated from the maternal side.

1. Variola.—This tends to run a severe course in the pregnant woman, cases of the confluent and hemorrhagic types being specially common. But mild cases, of course, occur in mild epidemics and in individuals protected in part by vaccination. Metrorrhagia occurs at times, and not necessarily in hemorrhagic cases. The frequency with which abortion occurs is directly proportional to the intensity of the disease. It is inevitable in the hemorrhagic type, almost inevitable in the confluent type, but occurs only in a minority of cases when the disease is benign. Prophylaxis and treatment call for no special mention here. Pregnant women should invariably be vaccinated under the same conditions as other indviduals.

2. Scarlatina.—This is considered elsewhere as a puerperal disease (Part VII). As a complication of pregnancy alone it is of rare occurrence, the gravid woman enjoying a relative immunity in comparison with the puerpera. Certain obstetricians hold that the disease may be latent during pregnancy, to assert itself after delivery. This is a mere opinion at present. Another view is that the exposed pregnant woman may transmit the disease to the fetus without herself becoming infected. Scarlatina which breaks out during pregnancy runs its course as in the non-pregnant. If the degree of infection is intense, abortion results.

3. Measles.—This is rarely described as a complication of pregnancy. The gravid have no special immunity toward measles, but are chiefly protected by having had the disease in childhood. The course of the disease appears to be identical in the pregnant and the non-pregnant. Abortion is favored by the high temperature and cough paroxysms. The relative frequency of abortion is hard to ascertain, but in certain small series of cases it is high (3 out of 4 times, 5 out of 7, etc.). Complications of measles are rare, and there is on record but a single case of death from bronchopneumonia. It is claimed that the tendency to post-partum sepsis and hemorrhage is increased, so that unusual precautions should be taken to ward off these accidents.

4. Typhoid Fever.—The severity of this affection in pregnancy is neither necessarily increased nor diminished. Statistics may give either a high or a very low mortality. The proportion of abortion and premature delivery is high, ranging, according to statistics, from 58 to 83 per cent. As a rule, all depends on the gravity of the case, although sometimes pregnancy will not be interrupted even in the most severe examples. Toxemia is doubtless the chief agent in bringing about abortion. Sepsis is said to be a common sequel of labor during typhoid fever, so that the patient becomes a victim of associate infection with two formidable maladies.

5. Typhus.—The few data upon record do not admit of the drawing of any conclusions upon the course of the disease in pregnancy or the frequency with which abortion is produced.

6. Erysipelas.—There is neither special disposition to nor immunity from this affection in pregnancy, nor is its course modified by the latter condition. Fatalities do not appear to have been recorded, and while abortion occurs with frequency, there are no statistics by which this may be determined.

7. Malaria.—There is less than the normal susceptibility to malarial attacks. It is sometimes developed during the puerperium; it is, however, probable that many cases reported as malarial have been cases of unrecognized sepsis. When malarial fever occurs in pregnancy, it may pursue an atypical course; abortion seldom occurs. The fetus may suffer from this disease, being born with evidence of it; *e. g.*, enlarged spleen. Quinin should be administered, as in the non-pregnant state.

8. Pneumonia.—In this disease the prognosis is grave in late pregnancy, owing to the diminished breathing space, the hydræmia, and the extra work which the heart has to perform. Interruption of pregnancy frequently occurs. The gravity of the disease and the tendency to miscarriage increase progressively during pregnancy, and are greatest in the later months. All the symptoms are aggravated by labor, hence the induction of labor is not indicated. Premature labor or abortion should be prevented, if possible. However, if labor begins, it should be hastened within safe limits. The heart should be sustained, and the same general treatment be pursued as in the non-pregnant state; cupping and full doses of strychnin are of great service.

9. Syphilis.—This is one of the most common causes of abortion (compare Placental Syphilis and Abortion). The virulence of the disease proper, however, does not seem to be increased, except that the initial lesion is apt to be very severe, owing, perhaps, to the genital hyperemia and the hypertrophy incident to pregnancy.

The *prognosis* will depend, to a great degree, on the resistant power of the patient, as well as on the septic micro-organisms which are associated with the micro-organisms of syphilis. Fournier has said that "a syphilitic woman who becomes pregnant is more likely to abort than is a pregnant woman who becomes syphilitic." *Treatment* should begin as soon as the infection is discovered, and be pushed just short of salivation, being in general the same as that of the non-pregnant state. For the local lesions, antiseptic, sedative, and drying powders should be used. Besides medicinal measures, tonics and systemic nutritious feeding are demanded.

XVII. SKIN DISEASES.

1. Pruritus. 2. Pigmentation. 3. Herpes Gestationis. 4. Impetigo Herpetiformis. 5. Alopecia. 6. Fibroma Molluscum Gravidarum.

Besides the ordinary affections of the skin, to which she is as liable as the non-pregnant, a pregnant woman may at times show eruptions which are intimately connected with her state. As a general rule, acne, psoriasis, and eczema are very much worse during the pregnant state. Not infrequently it happens that after its termination those of internal origin, eczema and psoriasis, disappear of themselves. The exanthems of eruptive fevers are not modified by a pregnancy they complicate.

1. Pruritus.—Itching is a symptom, not a disease. The term pruritus is limited in its use to conditions in which there are no evidences on the skin except those which result from scratching.

When the *diagnosis* of pruritus is established, it remains to determine the causative factor. Parasites, pediculi, and the itch mite must first be excluded. Various excitants, such as jaundice, intestinal intoxication, the toxemia of pregnancy proper, and nephritis, may operate in pregnant women.

There may be localized pruritus of the genitals from diabetes or leucorrhea; of the anal region from rectal ulcers or hemorrhoids. In this climate there is a pruritus (pruritus hiemalis) which comes on at the approach of winter, affects chiefly the wrists and legs, and is probably due to feebleness of circulation. After these factors are excluded, there remains a pruritus of pregnancy. Its causation is doubtful, but it is probably due to irritation of the peripheral nerves by circulating toxins. There is no eruption when pruritus begins, but when the patient is seen, secondary ones due to scratching are present. They are blood-crusted excoriations, generally linear, which may show various infections. The character of the latter are impetiginous or ecthymatous (see page 339). If the disease has lasted for any length of time, the skin is thickened, pigmented and its lines are deepened. There is often an indolent enlargement of the lymph-nodes. In all cases of general pruritus pregnancy toxemia should be suspected, and the urine examined for the total nitrogen and its compounds.

Treatment.—When pruritus is local, the cause should be removed at once. In general itching, the eliminative functions of bowels, skin, and kidneys should be stimulated. (See Toxemia of Pregnancy.) Copious draughts of water are recommended as a routine measure. Internally, the opium derivatives are not to be thought of. The patient usually demands relief at once, so local measures are of first importance. Practically all anti-parasitics are antipruritics—sulphur, naphthol, salol, menthol, thymol, camphor, and carbolic acid. They are used in lotion, alcoholic or watery, if the skin is not dry; if it is, ointments are preferable. It is better to use the latter in any case until pus infection disappears. In local pruritus, cleanliness is a necessity. Pledgets soaked in carbolic acid or Labarraque's solution may be placed between the labia or in the anus. Silver nitrate (5 to 10 per cent. solution) painted over the parts is helpful. Antipruritics, as a rule, are best combined with diachylon ointment.

2. **Pigmentation.**—The specific pigmentation of pregnancy has sites of election—the face and chest, especially the breasts. Pigmentation of the areola and nipple can hardly be regarded as pathological. Clinically, the color varies from a golden yellow to a dark brown. The spots vary in size up to a universal involvement. They are formed by coalescence or peripheral extension. The borders are sharply defined and rounded. Involution begins, as a rule, in the oldest portions. There is no disease for which pigmentation may be mistaken except tinea versicolor. In the latter affection the scales may be readily scraped off, and always show threads and spores of its fungus. Metabolic pigmentation of any origin is pretty difficult to remove. That of pregnancy has more tendency to disappear spontaneously than is the case in other states, and when it occasions no distress to the patient's mind, it is quite as well to let it alone. If it is disfiguring, its involution can be hastened on unexposed parts by strong exfoliative applications, such as a 20 per cent. resorcin ointment or a 10 per cent. salicylic acid collodion or plaster. The inflammation set up has a distinct effect in promoting absorption. On the face, these things are likely to do more harm than good. Peroxide of hydrogen or pyrozone (the weaker solution) has sometimes a good effect. It must be applied five or six times a day. A favorite formula is bismuth suboxid, ammoniated mercury, āā ℥j; lanolin, ℥j. The application is to be stopped temporarily when scaling appears.

3. **Herpes Gestationis** (*Dermatitis Herpetiformis*).—Its lesions have nothing distinctive about them. They consist of erythematous patches, not of great extent, sharply defined, without scales or infiltration; of papules which are tiny and pale, capped with blood crusts, like those of prurigo, or larger elements, red, pointed, and hard. On the patches of erythema or on the papules, vesicles may

appear which can be found on parts not readily reached by the nails. Lastly, bullæ may arise on a reddened base. The sites of predilection are the buttocks, backs of the thighs, flanks, and forearms, but in exceptional cases the eruption may spread over the whole surface. The mucous membranes are never attacked. The lesions all have a tendency to herpetiform grouping in clusters without coalescence, itch furiously, appear in successive crops, and leave deep pigmentation. The patient may get into a bad nervous condition with insomnia from the irritation.

The disease is due to faulty metabolism or toxemia. It follows shock and depressing conditions generally. It is a very rare complication of pregnancy.

Treatment.—Termination of pregnancy generally, but not always, brings an attack to a close. There are three things which are useful in the treatment of dermatitis herpetiformis. The first is rest, the second is arsenic, and the third is sulphur. Prognosis is good as regards life, bad as to recurrence.

4. Impetigo Herpetiformis.—It was formerly thought that this disease appeared only in pregnant women, but cases have occurred in the non-pregnant and in males. There appear about the ano-genital region, the umbilicus, axillæ, and inside of the thighs, groups of pustules which spread peripherally until a large part of the surface is covered. The mucous membranes are affected in the same way as is the skin. The disease may terminate with pregnancy, but usually it does not. The cases reported have all terminated fatally except two, either from an intercurrent pulmonary affection or in a typhoid state. Internal medication is useless except in the form of tonics and maintenance of nutrition.

FIG. 473.—FIBROMA MOLLUSCUM GRAVIDARUM.

5. Alopecia.—Loss of hair is not a common phenomenon in the pregnant state or immediately following it. Of the two periods, it is oftener developed post partum than in the course of pregnancy. There is a possibility, however, that the fall is noticed only when the hair has become thin. The fall is general, but the temporal regions are usually chiefly affected. It is rare that any part is completely denuded.

It would seem probable that this affection is to be classed with the alopecias of prolonged fevers. If so, it is a nutritional disturbance in the hair papillæ, doubtless toxemic in origin.

Treatment.—The women usually require iron and strychnin, hydrotherapy and forced feeding. Locally, something can be done in the way of prevention by careful attention to the scalp hygiene during pregnancy. Shampooing with tincture of green soap every fortnight and application of a 5 per cent. resorcin lotion are sufficient. After full development, as regards the shampoo, it is well to warn the patient that she may see a considerable loss at first. If

there is any scaling, the resorcin lotion should be used two or three times a week. A serviceable wash is salicylic acid gr. xx, resorcin one-half drachm, oleum ricini one-half drachm, oleum lavandulæ ten drops, alcohol one ounce. When there is no dandruff, pilocarpin is incomparably the best remedy. It cannot very well be used in injection on account of its depressant action, but it may be applied to the scalp every day in a one or two per cent. alcoholic lotion. The hair should be parted and the wash well rubbed into the roots. If the expense is too great, undiluted fluid extract of jaborandi may be substituted, but is not nearly so efficacious. Prognosis is always good.

6. **Fibroma Molluscum Gravidarum.**—Under the name of fibroma molluscum gravidarum, Brickner* has described a hyperplastic process which differs from the ordinary condition recognized by the same name only in its connection with pregnancy. The growths begin to appear about the fourth to the sixth month in the form of a number of small sessile or pedunculated elevations about the neck, breasts, and submammary region (Fig. 473). They may increase slowly in number and become pigmented to a degree varying with individuals. As a rule, they are smooth, soft, and polypoid in appearance, but owing to secondary growths may digitate, or if the subdivision is less marked, show a mulberry appearance. The pigment is melanin, a non-ferruginous, metabolic material deposited in the lowermost layers of the epidermis chiefly. Histologically, the growths consist of an increase of a rather acellular collagen, accompanied by a corresponding hyperplasia of the prickle-cells. Treatment is unnecessary, as the fibromas disappear spontaneously post-partum when other regenerative processes are complete.

XVIII. DISEASES OF THE OSSEOUS SYSTEM.

1. Relaxation of the Pelvic Joints. 2. Inflammation of the Pelvic Joints. 3. Osteomalacia. 4. Rachitis.

1. **Relaxation of the pelvic joints** is an exaggerated degree of the normal process by which the pelvis is prepared for labor (see page 114). On the other hand, it may be caused by a pathological state of the joints, such as inflammation. The sequelæ of this condition may be suppuration, fluid in the joints, and other abnormal conditions. Locomotion may be effectually hindered, and as a rule there are pains in these joints, as well as in the thighs and in the lumbar region. A firm binder gives great relief and is often a sufficient support for comfortable locomotion (Figs. 228 and 229). Rest in bed must occasionally be enjoined; the binder should be worn after delivery until the parts have returned to their normal condition. I am accustomed to make use of the same type of binder in these cases as after the early days of the puerperium (Part VI); a plaster-of-Paris bandage is, perhaps, necessary in the more severe cases.

2. **Inflammation of the Pelvic Joints.**—In rare instances an inflammatory process occurs in connection with the relaxation just mentioned. The symptoms are aggravated, the pain may be severe, and there is swelling over the affected joints, with tenderness on pressure. The *treatment* is the same as for simple relaxation, with the addition of anodynes and anodyne applications. Cold applications may be of service.

3. **Osteomalacia.**—This affection is rare in America, but endemic in Italy,

* "American Journal Obstetrics," vol. LIII, No. 2, 1906.

Austria, Switzerland, and other portions of Europe. The subjoined account is taken largely from Schuchardt's * work on diseases of the bones and joints.

The affected bones are of a lively red hue, and are either soft and flexible or show a high degree of porotic atrophy, a saw cutting through them as if they were rotten wood. In the very highest degree the periosteum is transformed into a sac containing a white, puffy mass which represents the original osseous tissue. As a rule, the marrow is unusually reddened, and commonly consists of lymph-marrow; in rare instances fat-marrow may be present, the color then being yellow. Cystic degeneration often occurs, and is thought to be salutary and to denote the resolution of the morbid process.

The naked-eye deformities in osteomalacia are numerous and characteristic. At first, while the patient is able to walk about, the changes are those produced by the weight of the body. There is a stronger bend to the neck of the femur. The pelvis takes on the characteristic clover-leaf form, the pubic bone becomes beak-like, the sacrum is bent toward the pelvic axis, the lumbar vertebræ are shortened and compressed and biconcave, suggesting the vertebræ of fish, etc. The base of the skull is elevated. The origins of large muscles, tendons, and ligaments often become unduly prominent because of the softness of the bones (osteomalacic enlargement of bones).

The long bones are, at the outset, almost non-participating, but eventually exhibit flexure and curvature. In the worst cases these bones become simply amorphous masses of flesh.

If recovery sets in in these cases, new osseous tissue is formed, the centers of the bones being occupied by osseous tubercula or enostoses.

With regard to the course pursued by puerperal osteomalacia, the disease seldom attacks women who live under hygienic requirements. Miserable, overworked, and underfed peasants, living in damp and unhealthful surroundings, are the principal victims. Even here certain endemic influences obtain, so that Italy and Switzerland take the lead over other countries in morbidity.

As a rule, multigravidæ are attacked by preference. The pelvic bones are first affected, and under the influence of the warmth of the bed, rheumatoid pains set in. Tenderness over one or both ischial tuberosities is an early symptom, interfering with sitting. The pains appear wherever softening is in progress. The patient loses rapidly in height, even to the extent of a foot or more. The joints appear to be involved in a sort of arthritis deformans, and fever is occasionally present. Changes in the muscles, not unlike those of progressive muscular atrophy, often occur. A peculiarity of gait is thought to be due to paresis of the ileopsoas muscle. Later on it is found impossible to abduct the thigh and eventually, of course, all locomotive efforts become impossible. The condition may last for years, with exacerbations and remissions. Particular deformities may result from various positions assumed while the patient is bed-ridden. In *diagnosis* this affection has not infrequently been confounded with various diseases of the spinal cord. Symptoms of great value in early diagnosis are isolated iliopsoas paresis, the diminution in height, and the alteration in the measurement of the conjugate. With regard to *treatment and prognosis*, Winckel has seen spontaneous recovery. Tonic and hygienic measures of all sorts are prescribed, and prolonged treatment with phosphorus appears to give excellent results. Cod-liver oil is usually given as a synergist. The fact that the pelvic bones have undergone softening and extensibility, despite the pelvic narrowing, does not favor the expulsion of the child. According to Litzmann, there occurred in 72 osteomalacic women only 21 natural labors. In 16

* In vol. XXVIII of the "Deutsche Chirurgie."

cases the fetal head was perforated; in 40, Cæsarean section was performed artificial premature delivery was the management in 2 cases and symphyseotomy in one. Seven women had rupture of the uterus, and four died undelivered. Porro employed his utero-ovarian amputation in these cases with much success. Fochier, of Lyons, and Levy, of Copenhagen, who have done many Porro operations in osteomalacic labors, came to the conclusion that the castration incidental to this form of intervention has a salutary effect upon the disease. In 1886 Fehling began to test this theory by the performance of simple castration in these cases, with an astonishing degree of success, and the practice has become general. Even after the first day from the time of operation the pains abate and the tenderness becomes less marked. In a small number of cases no benefit is received from the operation, which should not be performed until all other measures have failed. (See Section on Osteomalacic Pelvis, Part V.)

4. **Rachitis.**—(See Pelvic Deformity, Part V.)

XIX. THE PREMATURE INTERRUPTION OF PREGNANCY; ABORTION; IMMATURE LABOR OR MISCARRIAGE; PREMATURE LABOR.

Classification and Definitions.—An *abortion* is a termination of pregnancy before the placenta is formed; namely, in the first twelve weeks or three months. A *miscarriage*, or "*partus immaturus*," is the termination of gestation at any time from the end of the twelfth week, or third month, to the end of the twenty-seventh week, or six and three-fourths lunar months. A *premature labor*, or "*partus prematurus*," is the premature interruption of pregnancy, occurring at and after the twenty-eighth week, or seventh lunar month, and before the thirty-eighth week, or nine and a half lunar months. I look upon the classification which groups under the term *abortion* all cases occurring within the first twenty-seven weeks of gestation as also justifiable, because before this time practically no regard need be paid to the life of the fetus, which may be regarded as lost. I would, then, speak of early abortions in the first twelve weeks, and late abortions from the end of the twelfth week to the end of twenty-seven and a half weeks. Most of the German text-books on obstetrics look upon the separation of abortion and immature labor as unjustifiable, and consider the period of viability, at the end of the seventh month, to be the only admissible point of division. Most of the French text-books understand the term "avortement" to extend to the end of the seventh lunar month of gestation. According to this classification, abortions are pregnancies terminated in the first six and three-fourths months, or the first twenty-seven weeks; a further division is made into early abortions in the first twelve weeks, and late abortions, falling within the period from the beginning of the fourth to the end of the seventh lunar month; the term premature labor covers the remaining cases from the twenty-eighth to the thirty-eighth week. For fear of confusion of terms already generally accepted in this country, I hesitate to adopt this latter classification here. The period of viability is the time when the fetus can live apart from its mother, the turning-point between *partus immaturus* and *prematurus;* and this limit is generally placed at the end of the seventh lunar month, or twenty-eighth week, from conception. We must not lose sight of the facts, however, that, on the one hand, fetuses may not be viable until after this estimated date, because the calculation of

the duration of pregnancy is uncertain; and, on the other hand, that, exceptionally, children born previous to the calculated twenty-eighth week may live. There is to-day no doubt* that many children born before the end of the seventh lunar month may be saved by the use of the couveuse and of gavage, and that a certain proportion of the children born at the twenty-seventh, twenty-sixth, twenty-fifth, or even twenty-fourth week of gestation can be preserved. Budin claims to have saved 30 per cent. at the twenty-fourth week.

A *complete abortion* is one in which the fetus and membranes are cast off intact; an *incomplete abortion* is one in which the fetus is born, and the embryonic membranes, all or in part, remain in the uterus; an abortion is *inevitable* when such hemorrhage occurs, and the ovum descends into the lower part of the uterus, or when part of the chorion or liquor amnii escapes; a *concealed abortion* is one in which the embryo perishes, but is not expelled; in *missed abortion* the embryo dies, symptoms of threatened abortion occur and subside, and the ovum remains in the uterus for a varying length of time; *spontaneous abortions* are those which occur naturally, not being caused by artificial interference of any kind; *induced abortion* is one which is caused intentionally and artificially, for strictly medical

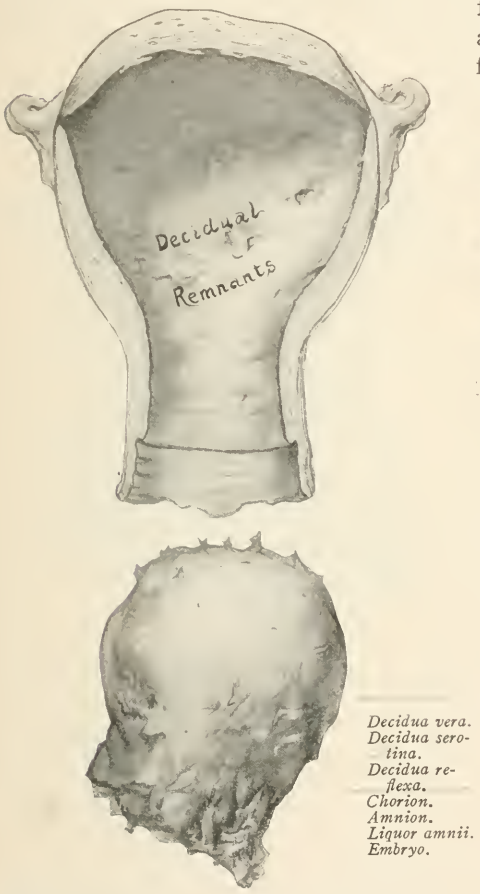


FIG. 474.—FIRST TYPE OF ABORTION. Retention of remnants of decidua only. So-called "complete abortion."

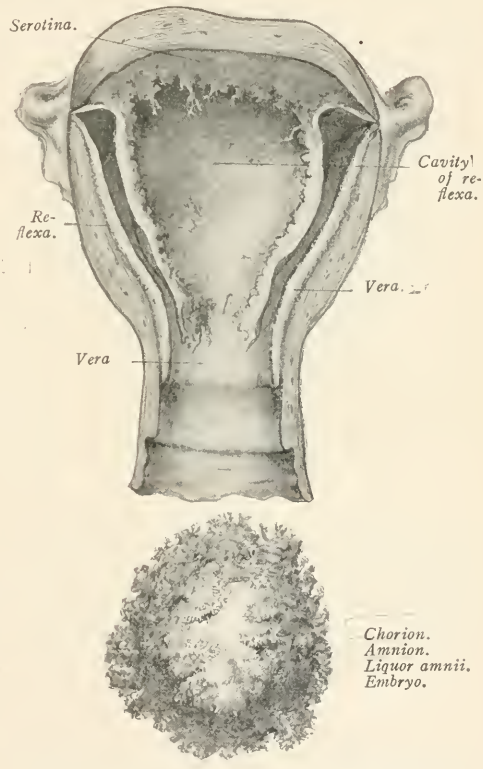


FIG. 475.—SECOND TYPE OF ABORTION. Retention of deciduæ. Incomplete abortion.

*Ahlfeld: "Arch. f. Gynäk.," VIII, p. 194.

reasons; *criminal abortion*, or *feticide*, signifies the act of attempting to procure an emptying of the uterus for other than strictly medical reasons, and the term holds good, whether the attempt proves successful or fails. The terms *slow* and *retarded abortions* explain themselves. *Therapeutic abortion* is one which is performed for strictly medical reasons.

Pathology.—*The Ovum:* In only exceptional instances does the entire ovum intact, with the vera, pass out in the first months. One can repeatedly, in curetting cases of apparently complete abortion, obtain pieces of tissue which the microscope proves to be decidua (Fig. 52). It is common for the reflexa to be

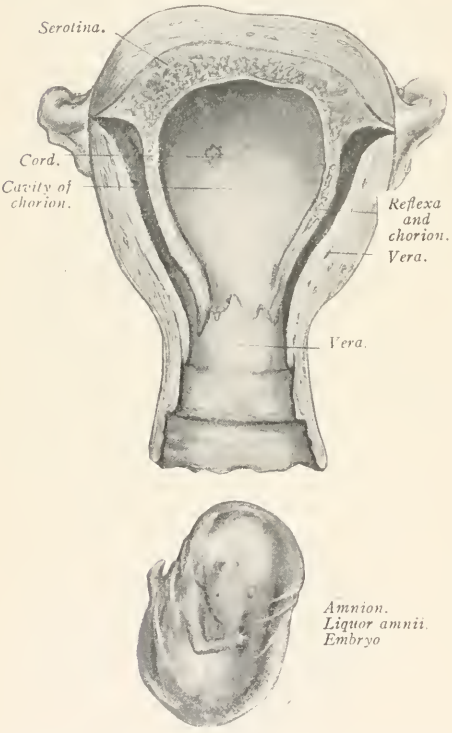


FIG. 476.—THIRD TYPE OF ABORTION. Retention of deciduæ and chorion. Incomplete abortion.

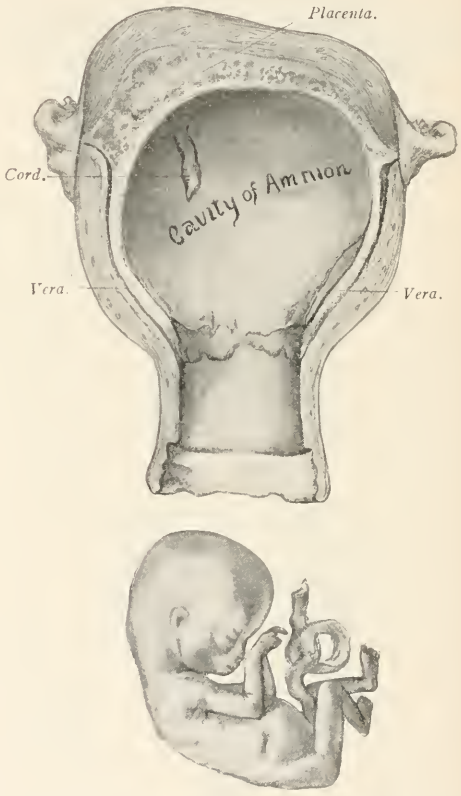


FIG. 477.—FOURTH TYPE OF ABORTION. Retention of deciduæ, chorion, rudimentary placenta and amnion. Incomplete abortion.

ruptured by the descent of the ovum, leaving the former, with the vera and serotina, to pass away during the puerperium, or to be removed by operation. Again, we infrequently see the chorion as well as the reflexa ruptured, the cord being torn from the placenta, and the fetus, enclosed in the amnion, with liquor amnii, alone expelled (Fig. 106). I have several specimens of this variety of abortion, and it has been observed as late as the sixteenth week (Fig. 106). A rare modification of this last process is shown when decidua vera, reflexa, and chorion are torn away, leaving the placenta (serotina) fitted like a cap on the amnion (Fig. 478). The further gestation has advanced beyond the twelfth week, the

more closely does the interrupted pregnancy resemble labor at term. *Moles:* In many cases the embryo dies early, but abortion does not occur at once; the result is a *uterine mole.* This formation consists of a sac with thick walls which are at first red, but which later become of a lighter hue (Fig. 479). The cavity is irregular and corresponds to the amnion; the entire space between the amnion and the external surface is bound by chorion within and decidua without, and is filled with blood, thus forming "blood moles" and "flesh moles" (Fig. 479). In many cases the fetus entirely disappears. If the fetus has not disappeared, it may retain a fresh appearance, despite the fact that it may have been dead many days; or maceration may take place, the mass becoming soft, flabby, and dark red; the fetal surface is covered with blebs; all the parenchymatous organs degenerate; the brain is fluid and the skull collapses. Such fetuses are not infected, and are sometimes spoken of as *fœtus sanguinolentus.* In other cases the fetus becomes dry or mummified, and may remain in the uterus for years (Figs. 444 and 445). In rare cases a second pregnancy may take place; in other instances the mummified fetus becomes

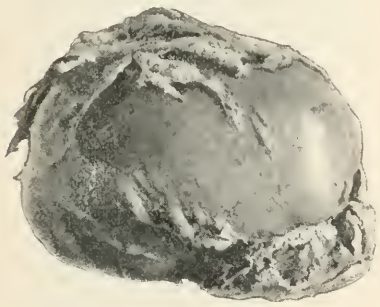


FIG. 478.—INCOMPLETE MISCARRIAGE AT THE FIFTEENTH WEEK. The amnion, covered by shreds of chorion and decidua, was expelled unruptured. Most of the chorion and decidua, and the entire placenta, were retained in the uterine cavity. ($\frac{2}{5}$ natural size).—(*Author's case.*)

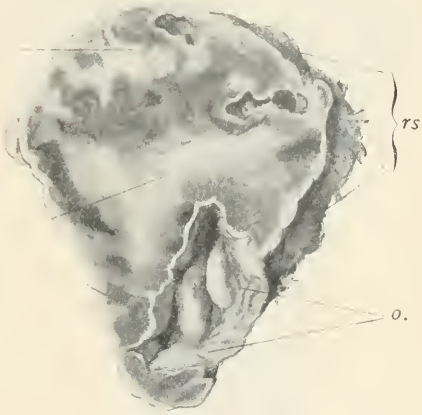


FIG. 479.—BLOOD MOLE CHANGING INTO A FLESH MOLE. *w*, White area in the blood mass; *b*, blood extravasation into rudimentary placenta; *rs*, outer rough surface of mole; *o*, ovum cavity with amnion cut open.—(*Bumm.*)

calcified, and is then termed *fœtus lithopœdion* (Fig. 446). *Periovular Hemorrhage; Placental Apoplexy:* Up to the end of the second month there is a marked tendency for the blood to spread out and form a thin layer $\frac{1}{6}$ to $1\frac{1}{5}$ inches (4 to 30 mm.) in thickness, upon the surface of the chorion, causing the ovum to resemble a piece of flesh, bluish or blackish in color. The enveloping membranes are seldom ruptured, and since this collection of blood is often larger than the ovum itself, it goes to show that the ovum is not the source of this hemorrhage. But later, in the third and fourth months, this tendency decreases, and the blood is apt to collect in a limited space in the placenta, forming placental apoplexies. This latter tendency increases with the advance of pregnancy (Figs. 482 and 483).

Frequency.—For many reasons exact figures as to the frequency of prematurely interrupted pregnancies are difficult to obtain. During the first eight weeks, undoubtedly, many interruptions of pregnancy pass unnoticed, and later in pregnancy very few such patients enter maternities, and many do not

come to the notice of private physicians or of dispensary hospital services. I have recently made an exhaustive study of the premature interruption of pregnancy occurring among ten thousand cases of labor treated in a dispensary or outdoor service, in New York city. In favor of a greater accuracy of these statistics is the fact that all of the 635 cases of interrupted pregnancy were outdoor or dispensary cases, and patients under such circumstances are more likely to seek aid under their own roof than to apply for admission to a general or maternity hospital. Among 10,000 cases of labor I found 635 premature interruptions; namely, 242 abortions, 175 miscarriages or immature

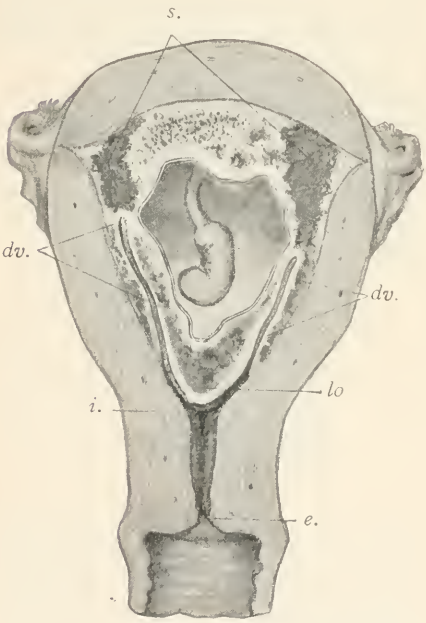


FIG. 480.—ABORTION AT THE EIGHTH WEEK. Separation of the (*dv*) decidua vera and (*s*) serotina from the uterine wall. Partial descent of the entire ovum; hemorrhage into the decidua reflexa; beginning dilatation of the (*i*) internal os. *e*, External os; *lo*, lower end of ovum.

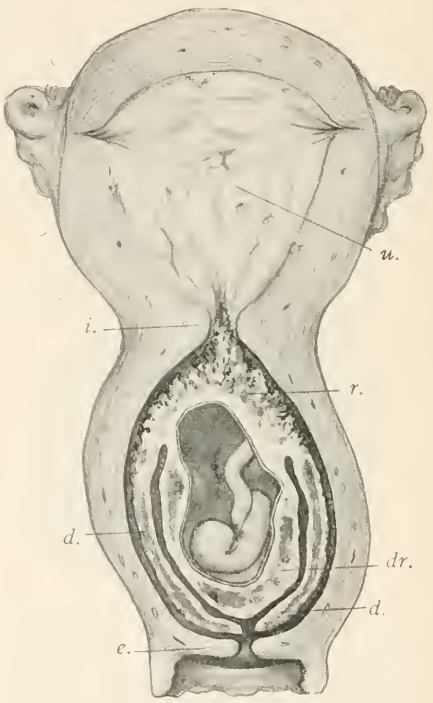


FIG. 481.—ABORTION AT THE EIGHTH WEEK. The ovum, entirely separated from the uterine wall, rests in the dilated cervical canal, the (*e*) external os alone preventing its escape into the vagina (*v*) —so-called "cervical abortion." *u*, Uterine cavity; *i*, internal os; *r*, rudimentary placenta; *dr*, decidua reflexa; *d*, decidua vera; *e*, external os; *v*, vagina; *i*, internal os.

labors, and 218 premature labors. The relative frequency, therefore, was one abortion in every 41.3 labors; one miscarriage or immature labor in every 57.1 labors; and one premature labor in every 45.8 labors. In other words, there was either an abortion, a miscarriage, or a premature labor once in every 15.7 labors.

Age of Patients.—In making out the percentages of the frequency of interrupted pregnancy, in different five-year groups or ages, I obtained the following results, namely: nineteen years and under, the percentage of interruption was 3.52 per cent.; twenty to twenty-four years, 5.01 per cent.; twenty-five to twenty-nine years, 6.02 per cent.; thirty to thirty-four years, 7.33 per cent.; thirty-five to thirty-nine years, 10.48 per cent.; forty to forty-four years, 18.94

per cent. From these studies I draw the conclusion that the smallest probability of an untimely interruption of pregnancy is before the twenty-fifth year, and that the greatest probability is after the fortieth year.

Parity.—In the table on page 348 has been arranged the relative frequency of cases according to the number of preceding labors (-para), added to the number of mature labors, under primiparæ, pluriparæ (pluriparæ II, III, IV, and Vparæ), and multiparæ.

The table shows that in primigravidæ, gestation is least endangered in the first months of pregnancy, and that the frequency of interruption in primigravidæ increases with the further advance of pregnancy. The table also shows that in

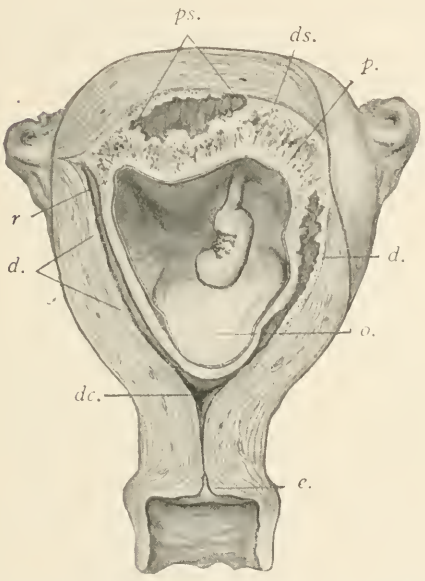


FIG. 482.—ABORTION AT THE TWELFTH WEEK. First stage. Beginning separation of the placenta and dilatation of the cervix. *d*, Decidua vera; *w*, uterine cavity; *dc*, dilated upper portion of cervix; *e*, external os; *p*, attached portion of placenta; *ds*, decidua serotina; *ps*, area of placental separation; *o*, cavity of ovum; *i*, internal os; *r*, origin of reflexa.

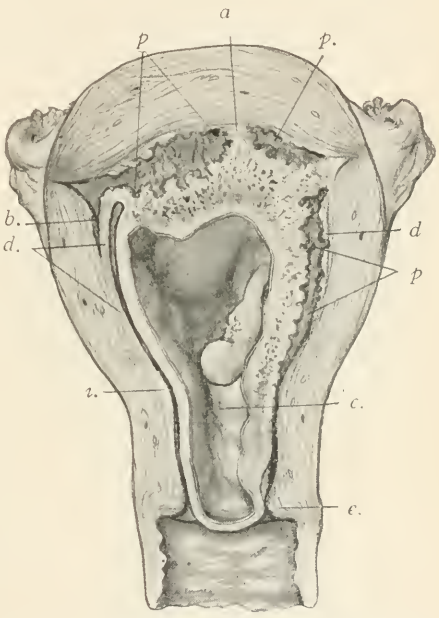


FIG. 483.—ABORTION AT THE TWELFTH WEEK. Second stage. *p*, Separation of the placenta except at its upper portion; *b*, beginning separation of the decidua vera, cervix dilated and contains the lower pole of the ovum; *u*, uterine cavity; *c*, cavity of ovum; *a*, attached portion of placenta; *i*, internal os; *br*, blood-injected reflexa; *e*, external os.

pluriparæ and multiparæ the relation is reversed; the majority of interruptions among these occurring in the first months of pregnancy, and that the frequency of interruption now decreases with the further advance of gestation. The greater frequency of uterine disease in multiparæ, and the large number of preceding labors, some of them undoubtedly anomalous, are a sufficient explanation of the greater frequency of abortion than of premature labor in multiparæ. With every additional interruption of pregnancy the length of gestation recedes, so that after the occurrence of a premature labor there ensue first miscarriages and finally abortions. The uterus, therefore, in the presence of uterine disease, becomes ever less tolerant of subsequent pregnancies, and expels its contents earlier, in proportion to the number of preceding interruptions of pregnancy, thus emphasizing Winckel's statement that "the longer existence of uterine disease leads to ever earlier interruption of pregnancy."

TABLE OF PARA.

Para.	Abortions.	Miscarriages.	Premature Labors.	Total Interrupted Pregnancies.	Total Full Term.	Total Interrupted and Full Term.
Primiparæ	29	22	71	122	2,009	2,131
Pluriparæ*	120	94	97	311	5,202	5,513
Multiparæ	79	49	46	174	2,047	2,221
Unknown	14	10	4	28	107	135
Total	242	175	218	635	9,365	10,000

Month of Gestation.—I found in the 635 cases, as will be seen in the table on page 348, that there is a marked tendency for gestation to terminate in the third month, 23.91 per cent. occurring at that time; in the fourth month, 11.18 per cent.; in the fifth month, 6.93 per cent.; in the sixth month only the slight liability of 6.15 per cent.; a slight increase in the seventh month to 9.60 per cent.; and in the eighth and ninth months the frequency again goes up to 12.63 per cent. and 12.25 per cent. respectively.

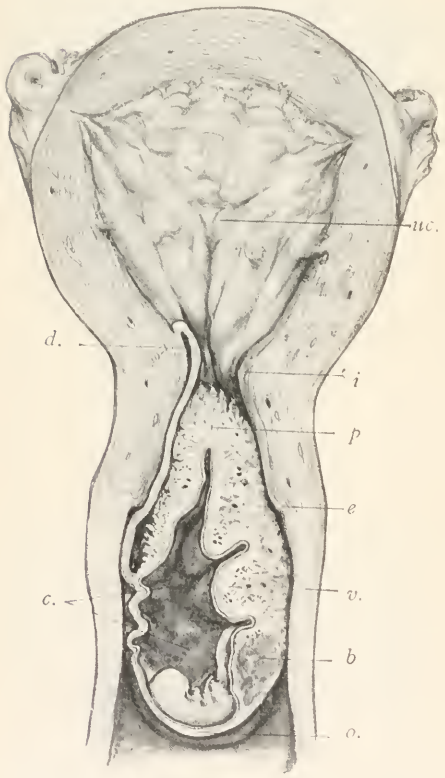


Fig. 484.—Abortion at the Twelfth Week. Third stage. The ovum, separated and expelled from the uterine cavity (*uc*), lies partly in the cervical canal and partly in the upper third of the vagina. A portion of the decidua vera (*d*) still remains behind in the uterine cavity above the internal os (*i*). *c*, Cavity of ovum; *o*, lower pole of ovum; *p*, placenta; *e*, external os; *v*, vaginal wall; *b*, blood-clots in the cavity or ovum.

Etiology.—The causes of interrupted pregnancy may be placed in three classes, and named in the order of their frequency (1) maternal causes; (2) causes in the ovum, embryo, and fetus; (3) paternal causes.

1. The *maternal causes* are divisible into the systemic and the local. The *systemic* causes include obesity, marriages of consanguinity, pregnancies in rapid succession, very hot climates, and very high altitudes. Poisons, such as syphilis, which holds the first place, are a frequent cause; *e.g.*, malaria; large doses of arsenic in skin diseases; lead and mercury in factories; the abuse of drugs known as oxytocics (ergot, cottonroot, quinin, aloes, juniper, black hellebore, tansy, pennyroyal, cantharides, any of these rarely disturb a healthy ovum in a healthy uterus); and the toxemia of kidney insufficiency. The effects of maternal toxemia on the fetus depend not on the intensity of the poison, but on the power it has to excite uterine irritability. In some cases this irritability is so easily aroused that a slight degree of toxemia will be sufficient to excite it, entailing the expulsion of the fetus before sufficient time has elapsed for it to perish from

* Pluriparæ in II, III, IV, Vparæ.

toxemia; while in others the fetus will suffer only from the prolonged effect of the poison, the uterus having so great a resistant power against the toxin. In the latter condition the irritability of the uterus has a mechanical, and not a toxic origin. The non-elimination of carbonic acid gas, in diseases of the heart, lungs, and liver; or violent mental shock or excitement, may interrupt pregnancy; but how this latter acts is not known. Anemia, tuberculosis, infectious diseases with high temperature, especially when the latter is suddenly developed, are also causes. The *local causes* include all causes of acute or chronic pelvic congestion, such as malformations and malpositions of the uterus, especially retro-displacements; metritis, endometritis, salpingitis, tumors, malignant disease; excesses in sexual intercourse in the newly married; traumatisms, as a blow or a fall; criminal use of instruments; all causes of obstructed venous return. Perhaps the most important is previous uterine disease, such as endometritis, which is quite common.

Week.	Month.	Number of Cases.	Percentage of Interruption.	
4	I.			
6	$1\frac{1}{2}$			10 Not Noted.
8	II.	61	9.61%	
10	$2\frac{1}{2}$	40	6.29%	232 Abortions.
12	III.	131	20.63%	
14	$3\frac{1}{2}$	21	3.31%	
16	IV.	62	9.76%	
18	$4\frac{1}{2}$	9	1.42%	
20	V.	35	5.51%	175 Miscarriages.
22	$5\frac{1}{2}$	9	1.42%	
24	VI.	28	4.42%	
26	$6\frac{1}{2}$	11	1.73%	
28	VII.	47	7.40%	
30	$7\frac{1}{2}$	14	2.20%	
32	VIII.	65	10.26%	218 Premature Labors.
34	$8\frac{1}{2}$	15	2.37%	
36	IX.	50	7.99%	
38	$9\frac{1}{2}$	27	4.26%	
			Total....	635 Interrupted Pregnancies.

2. The *causes in the ovum and embryo* are many of them secondary to morbid conditions in the mother, but at the same time are direct causes of interrupted pregnancy. The most frequent are those which interfere with the nutrition or cause the death of the embryo or fetus, and include decidual and placental syphilis, inflammations, and low situations of the placenta. Less frequent causes are other diseases and anomalies of the decidua, chorion, amnion, liquor amnii, placenta, umbilical cord, and the fetus itself, which produce the same result (see pages 191 to 243). As a rule, the fetus after death acts like a foreign body in the uterus, although now and then it is retained for some time, but rarely over two weeks.

3. Chief among the *paternal causes* is syphilis, resulting in syphilitic spermatozoa, syphilitic changes in the placenta and fetus, occurring in some instances with no sign of the disease in the mother; tuberculosis; extreme youth or old age; great constitutional depression, or exhaustion from any cause.

Relative Frequency.—The principal causes in the order of their frequency are (1) diseased endometrium; (2) retro-displacements of the uterus, with or without adhesions; (3) syphilis; (4) kidney insufficiency, toxemia; (5) criminal interference; (6) low insertion of the placenta.

Recurrent Interruptions.—The most frequent causes of instances of repeated interruptions in the same individual are (1) disease of the endometrium; (2) retro-displacements; (3) syphilis; (4) toxemia. In some instances the cause is so pronounced and permanent, especially in cases of chronic pelvic inflammations, that a tendency to abort at the same period in successive pregnancies exists, thus giving rise to the term "the abortion habit." Some abortions occur without any assignable cause, or from such slight cause that the accident has been ascribed to an "irritable uterus." As has been frequently pointed out by different observers (Winckel), a striking feature in the study of the etiology is the number of preceding premature interruptions of pregnancy.

In 407 abortions and miscarriages I found 38 women, or 9.1 per cent., who had experienced previous abortions or miscarriages; 103, or 24.7 per cent., who had experienced previous premature spontaneous labors; and 141, or 34 per cent., who had experienced previous interrupted pregnancies. Among 218 spontaneous premature labors, there were 15 women, or 6.9 per cent., who had experienced previous abortions or miscarriages; 44, or 20.2 per cent., who had experienced previous premature labors; and 59, or 26 per cent., who had experienced previous interrupted pregnancies. The most striking fact shown in the foregoing figures is the large number of previous untimely interruptions of pregnancy; for, as the figures prove, among 407 women who aborted and miscarried, 141, or 34 per cent., suffered from previous premature interruptions of pregnancy; and among the 218 cases of premature labor, 59, or 26 per cent., had experienced previous untimely interruptions of pregnancy.

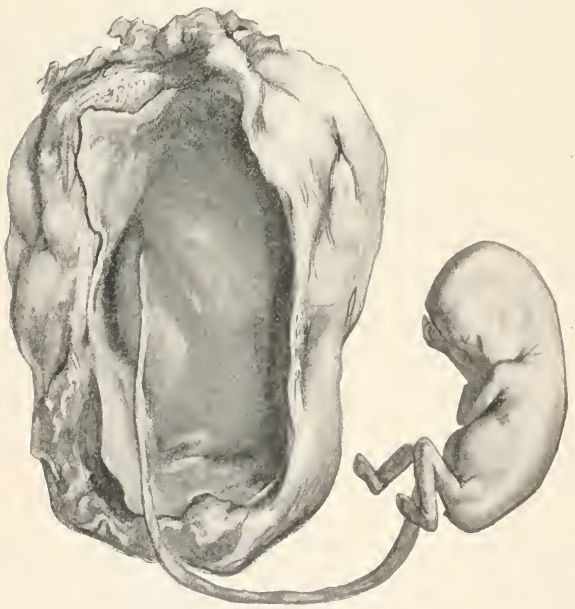


FIG. 485.—FLESH MOLE.—(*Author's Case.*)

Symptoms.—The symptoms of interrupted pregnancy vary with the different months of gestation; but usually premonitory symptoms of pelvic congestion occur, and the characteristic symptoms follow—namely, hemorrhage, pain dilatation of the os, descent and discharge of the ovum, embryo, or fetus. Great variations in symptoms occur between the first and thirty-eighth weeks of gestation. In the early weeks the clinical phenomena often resemble merely an exaggerated menstrual epoch, while at the eighth month all the phenomena of labor at term are present. A marked prodrome of spontaneous abortion and miscarriage is a tendency to syncope, and it should be remembered that abortions or miscarriages occurring suddenly are rarely accidental or spontaneous.

Clinical Phenomena.—1. *Abortion:* In abortion—namely, before the beginning of the fourth month—the clinical picture presented by the emptying of the uterus is usually altogether different from that of an interrupted preg-

nancy occurring subsequently. During the first three months the ovum is expelled as a whole, or broken up, with more or less profuse hemorrhage; hence it is that usually but a single stage of labor can be recognized; while after the third month the course of labor corresponds more and more with parturition at term, and in most instances three stages of labor can be distinctly differentiated. In the first six weeks we most frequently have "ovular abortions," so called because the embryo is still indistinguishable, the ovum being discharged intact (see Pathology) and unruptured, with marked hemorrhage but with little or no pain; the time of occurrence is apt to correspond with the menstrual epoch, and the little pain and backache present are attributed to menstruation and to the discharge of clots through a contracted cervix, the ovum passing away unnoticed. From the sixth to the twelfth week, "embryonal abortions" are more common, so called because the human form has not yet been fully assumed. In these we observe prodromal symptoms of pelvic congestion; the pain and hemorrhage are more severe; there is first an escape of the embryo, followed after a varying period, which resembles somewhat the prolonged third stage at term, by the retained decidua, chorion, amnion, and rudimentary placenta. The occurrence of abortion at this time is often preceded and accompanied by active symptoms, such as syncope, nausea, slight rigors, backache, increased vaginal secretion, frequency of micturition, thirst, pallor, and, in some cases, nervous symptoms. Later the pain in the back increases, and is perhaps attended with a feeling of intrapelvic pressure; free hemorrhage occurs, large clots are passed from time to time, and finally the ovum is expelled intact or in portions. For the symptoms of threatened, inevitable, complete, incomplete, neglected, concealed, missed, and criminal abortions, see Diagnosis.

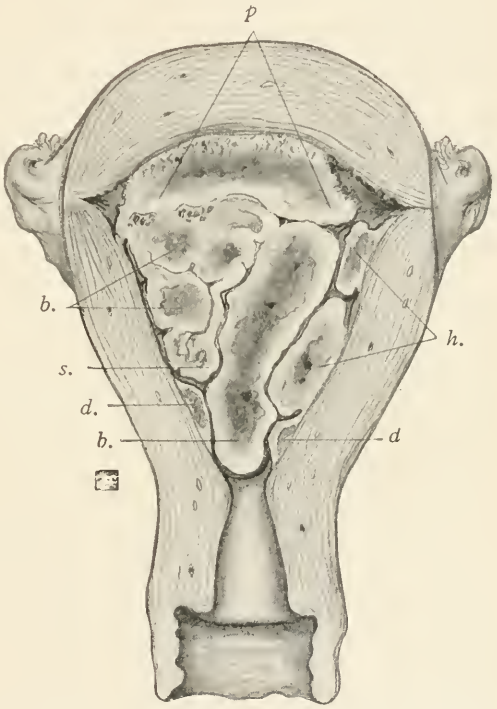


FIG. 486.—INCOMPLETE ABORTION. CERVIX READILY DILATABLE. *p*, Retained placenta; *b*, blood-clot; *s*, separated vera; *d*, decidua vera; *h*, hemorrhagic decidua vera.

2. *Miscarriage or immature labor:* As gestation advances through the fourth, fifth, sixth, and seventh months, we find the clinical phenomena of interruptions becoming more and more like labor at term. Three stages of labor can now be differentiated; the uterine contractions are more marked; severe voluntary bearing-down efforts appear; there is less and less hemorrhage in the first stage, and more at the end of the second and during the third; there is rupture of the membranes and a gush of liquor amnii; occasionally the ovum is discharged intact in the fourth, fifth, and even sixth months—fetus, liquor amnii, membranes, and placenta being discharged in one mass. The distinguishing

clinical characteristics of interrupted pregnancy, at this period, are retention of the placenta, which is completely or partially adherent, and profuse hemorrhage in the third stage.

3. *Premature labor:* In comparing the course of the process in immature and premature labors, we find that, clinically, the most important distinguishing feature between the two is the length of the third stage of labor. After the end of the twenty-eighth week the third stage of labor may differ in no way from the third stage at full term, while before the seventh month the third stage may continue days and weeks, unless its course is artificially terminated.

Duration.—The duration of interrupted pregnancy varies. The process may be quite rapid, or days or weeks may elapse. The average duration of abortions may be stated as between twenty-four and thirty-six hours. Abortion may be instantaneous. This is rare, and may result from a fall, which causes the immediate expulsion of the ovum, with hemorrhage. The time may equal that of labor, as more frequently happens, and hemorrhage and uterine contractions are the two essential features, either one or the other predominating, or both being of about equal importance. Slow abortion is yet more frequent than the two above types. The causes are weak uterine contractions and undue resistance of the cervix, or more often retention of the placenta with slow detachment. The latter feature depends on the extent of surface occupied by the chorionic villi. Placental retention occurs about fifteen times in a hundred cases. Retarded abortion is occasionally caused by the retention of the ovum in the cavity of the cervix, the "cervical abortion" of Schroeder (Fig. 481).

Diagnosis.—The diagnosis of any variety of interrupted pregnancy, abortion, miscarriage, or premature labor depends upon five prominent factors: namely, (1) the diagnosis of pregnancy; (2) pain (uterine contractions); (3) hemorrhage; (4) dilatation of the cervix; (5) descent of the ovum, embryo, or fetus into the os.

1. ABORTION.—The same difficulty often attends the diagnosis of an abortion in the early weeks, as the positive diagnosis of pregnancy during the same time. If the ovum has entered the internal os and can be recognized by the examining finger, no doubt will exist; indeed, in most cases the evidence of profuse hemorrhage and dilatation of the cervix will be sufficient. The ovum, if intact, can be distinguished by the fact that it becomes tense and is pressed downward during a pain. Clots should be carefully washed in water, in order that portions of deciduæ or fringe-like chorionic tissue may be recognized. The possible existence of extrauterine pregnancy should not be forgotten, however, for in this condition the expulsion of decidua may occur. The possibility of hemorrhage from cancer of the cervix or other morbid conditions, already described, should also be remembered. The physical signs do not differ materially in ovular and embryonic abortions. At first, on vaginal and bimanual examination, we find the cervix softer than would be expected; rather profuse hemorrhage from the os; the body of the uterus either hard from tetanic contraction or alternately hard and soft. Later, after several hours perhaps, dilatation of the os is observed; the ovum descends and may be palpated through the os with the examining finger, and perhaps there is effacement of the angle of anteflexion which exists early in pregnancy between the cervix and body (Tarnier's sign). This sign of inevitable abortion, described by Tarnier, is by no means constantly present. It is most important, at this time, to be able to distinguish with the examining finger between the ovum and a blood-clot situated just within the os. In *threatened abortion*

the clinical picture shows a hemorrhage bright in color, free from clots, intermittent in character, fairly persistent, and moderate in amount; there is little pain or none at all; the os is somewhat dilated, but does not allow the passage of the finger; the uterus is soft, anteflexed, and intermittent contractions are infrequent. The symptoms may subside, or persist and result in a complete or an incomplete abortion. As long as a chance of the subsidence of the symptoms exists, the abortion is said to be threatened. In *inevitable abortion* the hemorrhage is persistent, increasing in amount, and contains clots and fragments of the ovum and liquor amnii; pain and uterine contractions are present and increase in severity; the os is dilated and admits the examining finger, which palpates the ovum within the os; the uterus is alternately soft and hard, or is tetanically contracted. The ovum perishes and is expelled, or occasionally is retained, as in missed abortion. In *complete abortion* there is practically no hemorrhage; pain is absent; a slight discharge resembling lochia and containing small shreds of decidua is present; the os is closed; the uterus is hard and well contracted, and involution is progressing normally; there is a rapid subsidence of all the probable signs of pregnancy. The examination of the mass that has been expelled, which should always be made, will give the best results if the clots and blood are removed by washing in clean water. In the case of complete abortion the deciduæ will be seen closely embracing the mass, since the line of separation is in the spongy part. In order to detect any imperfection in the membranes, it is well to float them upon the surface of the water, when their structure will be clearly seen. In *incomplete abortion* hemorrhage is persistent, but varies in amount; it is at first bright in color, later dark brown, thick, and offensive; attacks of intermittent uterine pain, resembling "after-pains," are present; the lochia may contain shreds of decidua, amnion, or rudimentary placenta; the os readily admits the finger, and decidua, membrane, pieces of placenta, and blood-clots are found in the uterine cavity; the uterus remains persistently large and soft; involution is absent, and, with the exception of the enlargement of the uterus, the probable signs of pregnancy disappear. To sum up: if the pain and discharge continue from time to time, if the uterus is soft and boggy, if the os remains patulous, and if the examining finger detects retained portions of the ovum, the abortion is *incomplete*. In *neglected abortion* the clinical picture is the same as in incomplete abortion, with the addition of the symptoms of local and general septic processes (see Fever). In *concealed abortion*—namely, in cases in which the embryo perishes but is not expelled—the clinical phenomena are absence of hemorrhage and of pain; no discharge; the cervix is soft; the os is closed, but may admit the finger with firm pressure; the uterus, soft, flabby, has lost the usual resiliency of pregnancy, and fails to increase in size, rather diminishing; the signs of pregnancy, aside from the enlarged uterus, subside. In *missed abortion* there are all the clinical signs of threatened abortion, with a subsidence of the same, followed by those of either concealed or neglected abortion. In *induced or criminal abortions* the clinical phenomena may not differ from those of spontaneous, complete, or incomplete abortions.

2. Miscarriage.—In the second third of gestation the diagnosis of either pregnancy or a threatened interruption becomes much easier, because the signs of pregnancy are all more marked, the symptoms of miscarriage are of greater severity than those of abortion, fetal parts and uterine contractions are readily recognized, and there are the formation of a bag of membranes and the escape of liquor amnii.

3. Premature Labor.—The diagnosis of premature labor becomes practically the diagnosis of labor at term. (See Part IV.)

Differential Diagnosis.—Abortion and miscarriage are to be differentiated from menorrhagia, metrorrhagia, dysmenorrhea, and ectopic gestation. Differentiation is also called for between threatened and inevitable, complete and incomplete abortion, and between an ovum and a blood-clot. It is a matter of importance to distinguish between *threatened* and *inevitable abortion*, since the treatment of the latter condition is radically different from that of the former. In threatened abortion the discharge is usually of a bright red color and free from clots, whereas in inevitable abortion large clots and perhaps portions of ovum may be present. In threatened abortion there is little or no pain, while in inevitable abortion, especially after the first month, the pain may be considerable. Instances have been recorded in which the os has admitted two fingers, but has subsequently closed and the symptoms have disappeared; in which fragments of decidua have been expelled from the uterus and yet the case has gone on to term; but in general it may be said that if there are much pain and profuse hemorrhage, if the cervix admits the finger, and if the ovum can be felt, there is little doubt as to the result. Tarnier's sign has already been mentioned (page 352). To distinguish between *a complete* and *an incomplete abortion* is also important, with reference to treatment, in order to determine whether the uterine contents have been wholly or only partly expelled. The discharge of an intact ovum will, of course, settle the question. If the hemorrhage and pain cease, if the os is closed, and if the uterus, although still large, is firmly contracted, and there is a disappearance of the signs of pregnancy, especially the milk secretion, the abortion is probably complete. In order to differentiate an ovum from a blood-clot by the palpating finger, Holl's sign may be of service. (*a*) During a pain, caused by uterine contraction, the ovum, increased in size, smooth and tense, advances, while a blood-clot does not become tense, nor does it advance. (*b*) The ovum presents a tense, resilient, and convex surface, while the blood-clot is cone-shaped, apex downward, and non-elastic. (*c*) If pressure is exerted on the fundus, in case the mass is an ovum, motion is not transmitted to it as a whole, on account of its resiliency, while the blood-clot would be moved *en masse*, on account of its solidity.

Prognosis.—*Mortality:* Among the 242 cases of abortion studied there were no deaths from any cause; among the 175 cases of miscarriage, one death from placenta prævia and ruptured uterus occurred; and in 175 spontaneous premature labors there were four deaths,—one from placenta prævia and hemorrhage, one from sepsis and bronchopneumonia, two from nephritis and eclampsia. These cases were all cared for in their own homes. The prognosis of spontaneous interruptions is good, under intelligent treatment, and when the cause of the interruption is not in itself a menace to life; such as high temperature from an acute general disease, placenta prævia, nephritis, or eclampsia. In criminal interruptions, on the other hand, the prognosis is bad, by reason of the unskilfulness of the procedure admitting air and septic matter into the uterus, the secrecy surrounding the affair, and the accompanying moral shock. In neglected or improperly treated cases the mother is exposed to the dangers of immediate and late septic infection, of hemorrhage, of endometritis, and to a long train of remote evils, including the liability to subsequent abortions.

The immediate dangers of interrupted pregnancy are: (1) hemorrhage; (2) retention of an adherent placenta; (3) sepsis; (4) tetanus; (5) perforation of the uterus with a curette.

1. *Hemorrhage.* This complication causes alarm only when it is present

in an extreme degree. It is the general symptoms resulting which are especially to be feared; namely, the tendency to syncope, disturbances of the special senses, etc. Hemorrhage predisposes to septicemia, but in itself is not often fatal. Persistent hemorrhage, though slight, induces a condition of weakness, strongly predisposing to infection later. Hemorrhage in abortion, as a prominent symptom in the early stages of the 242 cases studied, occurred in 85.57 per cent., thus agreeing with what has already been stated regarding the frequency of hemorrhage at the outset of abortion cases proper. Of these 242 cases, 214 were subjected to curettage, shortly after being seen, and in only one case was there subsequent hemorrhage. In the 175 miscarriage cases, hemorrhage as a prominent symptom before or during labor occurred in 66.29 per cent. of cases; 111 of these 175 cases were subjected to curettage shortly after being seen, and subsequent hemorrhage took place in five cases. In the 218 cases of spontaneous premature labor, hemorrhage before or during labor occurred in 6.42 per cent., and after delivery in four cases. Eight of these hemorrhage cases were the subject of placenta prævia.

2. *Retention of adherent placenta*, which demands an expression, a digital or manual removal, or a curettage after removal, is common in the fourth and fifth months, and becomes less so as full term is approached (Fig. 486).

3. *Septic infection*. This may be due to decomposition of retained placenta, or to faulty asepsis and antisepsis in the technique of the treatment. The pulse usually gives the first signal, which is followed by fever, rigors, suppression or putridity of the lochia, etc. Death may come quickly or slowly, or by care it may be warded off, though there may be left behind lesions of the uterus and its adnexa. I found that fever as a complication occurred, among 242 abortions, in 11.57 per cent., two-thirds of this only being due to sepsis; in 175 miscarriages fever as a complication took place in 21.71 per cent., three-fourths of this being caused by septic infection; and in 218 spontaneous premature labors fever occurred in 19.27 per cent., one-half only of this amount being due to uterine sepsis. Pyemia is especially common after abortion, infection taking place usually at the placental site.

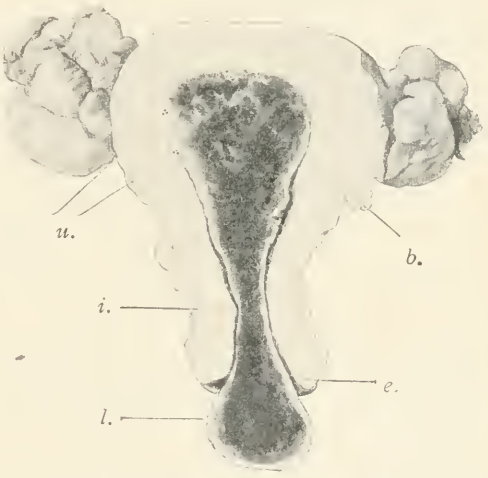


FIG. 487.—PLACENTAL POLYP IN SITU. Drawn from a specimen. *u*, Utero-placental arteries; *i*, internal os; *l*, lower portion of polyp hanging in vagina; *b*, blood-injected placental remnants; *e*, external os.—(*Bumm.*)

4. *Tetanus*. This is frequently reported as a sequel to abortion and miscarriage, but is most often an accident in the course of a general septicemia. In the 242 abortions, 175 miscarriages, and 218 spontaneous premature labors already referred to, no case of tetanus occurred. Although a rare condition, it was observed twenty-one times by Bennington, who collected 41 cases of puerperal tetanus.

5. *Perforation of the uterine wall*. Numerous cases of perforation of the uterine wall, during curettage after abortions and miscarriages, have occurred. The

danger of perforation is reduced to a minimum if the curette, when introduced into the uterus, is passed cautiously to the fundus, and then, with a firm downward stroke, is used to clear the uterine walls, especially at the horns.

The remote dangers of interrupted pregnancy are: (1) subinvolution and displacements; (2) septic sequelæ; (3) endometritis; (4) polypi; malignant disease; (5) sterility; (6) anemia; (7) recurrence; (8) neuroses.

1. *Subinvolution and displacements.* Involution takes place more quickly than after labor at term, unless the abortion is incomplete; its progress being delayed by septicemia and retention of the membranes. Subinvolution is not uncommon after interrupted pregnancy; and often causes displacements. Subinvolution is at times accompanied by a tendency to metrorrhagia, which leads to anemia and debility.

2. *Septic sequelæ.* Local or general sepsis, which sometimes follows abortion may each induce a train of serious sequelæ. The former is responsible for endometritis, metritis, perimetritis, parametritis and pelvic abscess, salpingitis, oöphoritis, and sterility. Remote infections may develop as sequelæ, as shown in the occasional supervention of suppurative arthritis and other pyæmic processes at a distance from the pelvis.

3. *Endometritis.* As regards endometritis, diametrically opposite opinions are maintained. Stumpf, Winter, and Puppe say that it is not the result of abortion and retention of membranes, and point to Veit's curetted cases, in which the endometritis had to be treated after the puerperium was ended They neglect to suggest the possibility of a prior abortion, expectantly treated being at the bottom of the trouble. Reference to the figures given below shows a 15.3 greater percentage of subsequent pregnancies when the secundines were instrumentally removed, which is tolerably fair evidence that these cases were free from endometritis.

4. *Polypi; Malignant disease.* The non-septic residue of the embryo, persisting within the uterus, may become nourished and develop into decidual and placental polypi, and even into that rare and peculiar formation known as deciduoma malignum, although this is seen more commonly after molar pregnancy (Fig. 487).

5. *Sterility.* Many authorities hold to the opinion that a uterine mucous membrane, completely renewed after an abortion, by reason of a curettage is less capable of playing the part of a decidua of pregnancy than one that has done so before in whole or in part.*

Certainly, my figures lead one to a far different conclusion from Puppe's. Of 119 cases treated by instrumental curettage, 38, or 31.9 per cent., had experienced one or more previous interrupted pregnancies; 5, or 4.2 per cent., suffered subsequently in the same way; 48, or 40.3 per cent., gave birth to living children at term; and 21, or 17.6 per cent., were found to be pregnant from the fourth to the eighth month when visited. These observations were made at the patients' homes and the children were seen. Of 28 cases of abortion expectantly treated, 10, or 35.7 per cent., had had similar previous experiences. None suffered from subsequent interrupted pregnancies; 7 gave birth to living children at term afterward (25 per cent.); 5, or 17.8 per cent., were found to be pregnant from the fourth to the eighth month when visited.

6. *Anemia.* The hemorrhage which accompanies the act of abortion may be so profuse, especially if the pregnancy is well advanced, that a condition

* Puppe: "Untersuchungen über die Folgezustände nach Abortus." Inaug. Dissert., Berlin, 1890.

of acute anemia, with all its sequelæ, may be established. Hemorrhage due to subinvolution has been mentioned (page 354).

7. *Recurrence.* The tendency to a recurrence of abortion, and to the establishment of habitual abortion, may be set down, with justice, as a sequela of interrupted pregnancy, which is highly important by reason of its frequency.

8. *Neuroses.* Finally, American authorities enumerate a tendency to functional neuroses, and even to psychoses, as one of the sequelæ of the interruption of gestation. The pathogeny of these affections is obscure.

Treatment.—1. *Prophylaxis:* In habitual premature interruption the cause or causes should first be sought. The various conditions which are known to favor miscarriage should be considered, one after the other; the uterus itself should first be examined; if conception has not taken place, any anomaly which is apparent, such as malposition, endometritis, laceration of the cervix, etc., should receive suitable treatment. If syphilis exists in either parent, a thorough course of antisyphilitic treatment for several months should be insisted upon, irrespective of previous medication; uterine displacements should be corrected, and the uterus may, if necessary, be kept in position by a suitable pessary for the first three months, care being taken, however, that the pessary causes no irritation; endometritis or other intrapelvic disease should be suitably treated. For the various morbid conditions causing sterility, and their appropriate treatment, the student is referred to works on gynecology. If the woman is already pregnant, the uterus is beyond the reach of treatment, save that a pessary may be worn for retroversion, during the first three or four months. Coitus should be forbidden during pregnancy, and rest in bed for a few days before and after the dates corresponding to the usual menstrual epochs is advisable; the use at this time of the fluid extract of viburnum prunifolium, and the uterine sedatives—hydrastis canadensis, Jamaica dogwood, and pulsatilla—is also advised. Everything that causes mental or physical shock or fatigue—excitement or worry; exercises, walking, standing, prolonged physical exertion; improper diet; the use of violent purgatives; railway journeys or automobile riding over rough roads—must be avoided. Conditions which predispose to abortion, such as severe coughing, vomiting, and intercurrent diseases of pregnancy, should receive prompt attention. Another method of dealing with habitual abortion is to forbid pregnancy until a given interval has elapsed. This is probably the best means for meeting the indication, for the tendency to abortion is not inborn but acquired, and physiological rest will enable the uterus to outlive this faulty condition.

2. *Threatened interruption:* Abortion becomes inevitable when the ovum is dead; this condition, however, in the early months can only be inferred. The criteria upon which to base an assumption of this event are two: the amount of hemorrhage, which when extensive argues for the existence of a corresponding degree of separation of the ovum, and the degree of dilatation of the os. We should not act upon the supposition that death of the ovum has occurred, for the patient should be given the benefit of the doubt, but wait until a certain period has expired, during which the hemorrhage may subside and the os close. After the sixth month we can tell whether the fetus is dead, and in every case an attempt should be made to save the life of the child. The patient should be kept in bed in a quiet, darkened room; the rectum and bladder attended to; simple liquid diet used, and physical and mental rest secured by sedatives. If marked symptoms are present, ¼ of a grain (0.016 gm.) of morphin may be given subcutaneously, and the bromides, with viburnum prunifolium and hyoscyamus, administered by mouth; the patient remaining

in bed for several days after all symptoms have disappeared. A useful prescription in these cases is: Sodium bromide, half an ounce (16 gm.); simple elixir, three ounces (96 gm.); tincture of hyoscyamus and extract of viburnum prunifolium, of each half an ounce (16 gm.). Take two teaspoonfuls, in a sherry glass of water, every three hours. It may be necessary to continue this line of treatment several weeks, and it is justifiable when we observe an increase in the size of the uterus and other signs that the fetus is alive. The management should be the same, whether the chances are in favor of or against saving the ovum, and the general principles of treatment are the same as in the prophylaxis of abortion. The best sedative is opium, which may also be required as an anodyne if pain is present. If the loss of blood is excessive, some hemostasis must be effected, but ice-bags and tampons are alike contraindicated, since either might have an oxytocic action. Our only resources are postural, viz., elevation of the pelvis and, possibly, cold compresses to the vulva. If, after several hours, it becomes evident, from the extent of hemorrhage, uterine contraction, and dilatation of the os, that abortion is inevitable, the treatment for that condition should be instituted. If, on the other hand, the symptoms improve, the treatment should be continued until hemorrhage and pain have subsided, and in any case for at least forty-eight hours. After this, the patient should be regarded as on probation for a week longer, if there is any recurrence of pain or metrorrhagia.

3. *Inevitable interruptions; early abortions:* Authorities are at variance as to the indications. Shall the emptying of the uterus be left to nature, or is it the physician's duty to evacuate this organ at once? Is it possible that each of these plans has its legitimate field? Or, is it possible to combine the two plans, by a compromise, without treatment? All methods for the management of inevitable abortion may be systematically classified as follows: (1) Purely conservative or expectant treatment. Interference is altogether interdicted, and sole reliance placed upon the tampon, vaginal irrigation, and ergot. (2) Early artificial removal of the decidua or placenta, active treatment so called, in which curettage is the routine plan. (3) An intermediate or eclectic method, in which intervention is resorted to only in order to control hemorrhage or sepsis. The indications for treatment, in all cases of inevitable abortion, are the same: namely, first, to control the hemorrhage; and, second, to secure complete evacuation of the uterine contents. Both are best fulfilled by instrumental curettage of the uterus, and as a temporary measure, to control hemorrhage while preparations for curettage are in progress, the vaginal tampon is most valuable. The latest observations tend to show that in abortions, contrary to the generally received opinion, the separation of the decidua vera from the uterine wall takes place from above downward, and that consequently the complete removal of the decidua by the finger seldom, if ever, takes place. Moreover, the removal of small fragments of decidua is easily accomplished by the curette, while it is difficult, if not impossible, by the finger. Other advantages of the curette are that less dilatation of the cervix is necessary, the operation is less painful, and anesthesia is not always required. I advise, in all cases of inevitable abortion and in those in which the accident has already occurred (incomplete), that the patient be plainly told that a curettage is necessary, leaving entirely out of consideration the amount of hemorrhage as an indication for interference; and if, upon explaining the danger of retained secundines to her, consent for curettage cannot be secured, then only should the first method of purely conservative or expectant treatment be followed—namely, relying upon the vaginal tampon, irrigation, and ergot. The patient's

consent having been obtained, curettage is performed in as short a time as possible. The vaginal tampon is useful in all cases in which hemorrhage is severe and the curettage cannot immediately be performed; it effectually controls hemorrhage, aids in the separation of the decidua, and in the dilatation of the os. (For curettage, instrumental and digital, and vaginal tamponade, see Operations, Part X.)

I advocate the active treatment of abortion, inevitable or incomplete, by reason of the analyses of the records of many hundreds of cases, treated

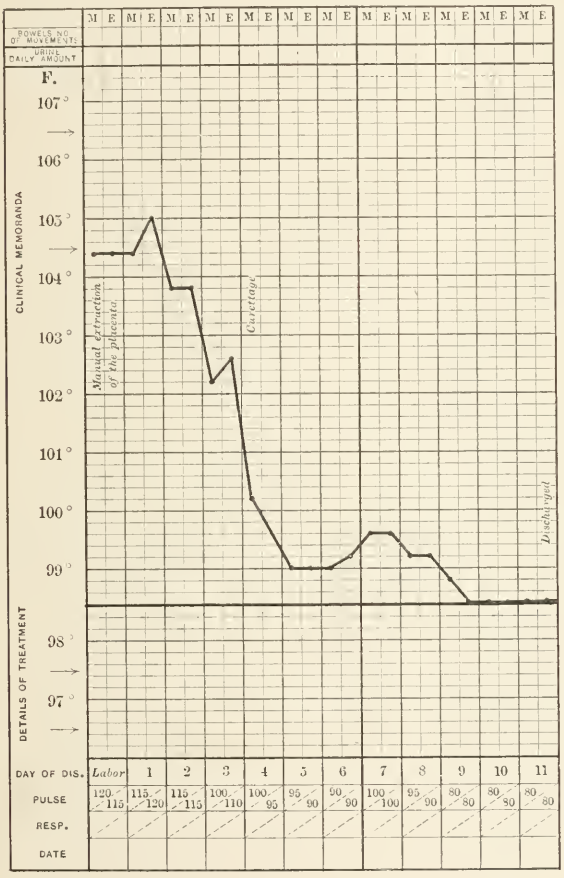


FIG. 488.—MISCARRIAGE AT FIVE AND A HALF MONTHS; MANUAL EXTRACTION OF THE PLACENTA; SEPTIC INTOXICATION; CURETTAGE ON THE FOURTH DAY.

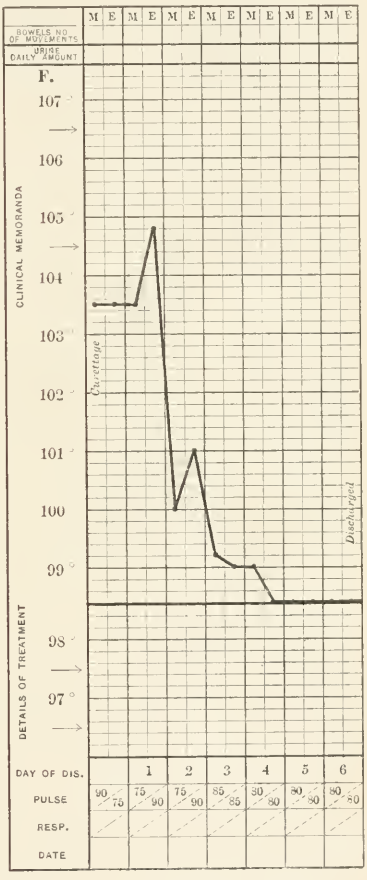


FIG. 489.—INCOMPLETE EARLY ABORTION. SEPTIC INTOXICATION; CURETTAGE.

by various methods, and especially from an exhaustive study of the pathology, bacteriology, duration, complications, sequelæ, and treatment of 242 cases; 166 of which were treated by instrumental curettage; 45 by combined instrumental and digital curettage; 3 by digital curettage only, and 28 by a purely expectant treatment. Contrasting the expectant and active plans of treatment of abortion, I believe the latter is less dangerous than the abortion and its sequelæ in cases of retention, and curettage makes sure that everything is removed; involution and time are necessary for convalescence after abortion;

the one is hastened, the other cut short, after curetting; this is, of course, a boon to the working classes; the expectant plan requires two weeks for itself alone; after instrumentation the patient may leave her bed on the fifth day; pain and physical discomfort, as well as mental perturbation, are less than in the expectant method; moreover, a large proportion of so-called complete abortion cases are followed by hemorrhages, subinvolution, acute and chronic sepsis; hemorrhage is always greater with expectant treatment; not more than half an ounce is lost by instrumentation, before the fourth month. In the first two months and a half, emptying of the uterus can be accomplished with curettage alone, the canal admitting the finger with difficulty and pain if anesthesia is not used. Uterine atony is controlled by irrigation and uterine tamponade with gauze; ergot is rarely called for, the placental forceps only occasionally. If curettage for any reason cannot be accomplished at once, the vagina may be tamponed with sterile gauze until the operation can be carried out. This course may also be pursued when curettage is refused, and the gauze packing may be left in for twenty-four hours. Again, if the accoucheur is a beginner, who dreads assuming the responsibility of forced dilatation and curettage, he is justified in adopting the conservative plan, and in temporizing with a gauze pack until dilatation occurs. Inevitable abortion may terminate, in a small number of cases, in expulsion of the ovum almost entire in which case it is arrested in the cervical canal. Under these circumstances curettage may not be necessary, as hemorrhage may cease after simple extraction with the finger or forceps. In case the ovum is too large to pass through the os, the latter may be dilated.

Late abortions. In the management of late abortions the treatment which has been advised for early abortions is preferable during the early portion of the second third of gestation; since clinically we are unable to draw the line so sharply between early and late abortion as some authorities would have us do. With the advance of pregnancy the treatment should become less and less aggressive, until it gradually merges into that of premature labor and labor at term. The real criterion of late abortions is the marked prolongation of the third stage of labor, which is due to the facts that placental development has occurred, and that the placenta is frequently adherent to the uterus. In the removal of an adherent placenta the manual method, as stated, is usually preferable, while for the removal of the decidua the curette is to be preferred. It is best not to use the curette to remove the placenta after the twelfth week. It is not consistent or safe to do so, and as a greater number of abortions occur at the third month, the method of treatment must be a combined one. The separation of the placenta is readily accomplished by digital curettage; the curette removes the decidua vera. Bimanual compression of the fundus uteri by two fingers internally and the other hand externally upon the abdomen, as a method of placental expression, is quite painful, frequently ineffectual, and is not to be recommended.

4. *Incomplete and septic abortions:* If the fetus has been expelled from the uterus, the membranes and placenta remaining behind, the indication is to curette at once, even if forcible dilatation is required. In suspected and established sepsis the greatest care must be used in all examinations and operative procedures not to open up new areas for infection. Sepsis may not be recognized as such, but we may assume that it is present if a high pulse exists, with or without fever. In this class of cases, as in infection after labor at term, I use the gentlest means to clear the uterus of retained material. Usually the finger and irrigation are sufficient. In exceptional cases I still resort to the

dull curette where the size of the uterine cavity or the nature of the retained matter do not allow of the efficient use of digital curettage. The uterus is then irrigated with several quarts of a saline or antiseptic solution, and further intrauterine treatment is contraindicated, with the possible exception of an occasional irrigation, most carefully administered. The remaining treatment of septic abortion does not differ from that of puerperal sepsis in general.

Premature labor. This is the same as the management of labor at full term. (See page 463.)

After-treatment.—The after-treatment of abortions, miscarriages, and premature labors should approach as nearly as possible to that of the puerperium at term. (See Part VI.) Unfortunately, after early interruptions of pregnancies patients insist upon making light of the condition, leave the recumbent position too early, and generally abandon treatment so essential for the attaining of proper involution. Involution is relatively slower after abortions and miscarriages than during the normal puerperium; hence the dangers of subinvolution, uterine displacements, and pelvic inflammations should always be explained to the patient, and the importance of the same attention to the condition as after labor at term. The combined and persistent use of ergot and strychnin I have found of the greatest value in hastening involution and in preserving the tone of the uterine ligaments. I use one or two grains (0.06 to 0.12 gm.) of ergotin, and one-thirtieth (0.002) of a grain of the sulphate of strychnin, three times a day, in capsules or tablets. As lactation is absent, this function does not constitute an objection to the use of these drugs. Vaginal and uterine irrigation is unnecessary, except after incomplete or neglected abortion, or miscarriage with symptoms of uterine sepsis. Late in the puerperium very hot vaginal irrigations are of benefit in assisting involution. Ergot and its derivatives must not be given until the uterus is free from the products of conception. It is just as necessary for a physician to know how to treat abortion as it is to treat normal labor, and the matter should receive adequate attention in the schools.

XX. ECTOPIC GESTATION.

Definition.—Ectopic gestation or extrauterine pregnancy consists in the development of the fertilized ovum outside of the uterine cavity.

Varieties; Site.—Despite the occasional alleged development of the ovum in some one of a variety of atypical localizations—ovary (Fig. 490), angle of uterus (Fig. 491), abdominal cavity, etc.—the vast majority of cases occur within some portion of the Fallopian tube; usually toward the ovary (Fig. 493). This variety is known as the ampullar. Development of the ovum midway in the tube or at its uterine extremity is very infrequent. Hence for practical purposes ectopic gestation may mean an ampullar gestation—in other words, a phenomenon beginning at some distance from the birth-tract, and in a region which is the seat of many of the most important gynecological affections (ovarian diseases and tumors, pus-tubes, hematomata, etc., etc.). Gestation in one born of a bicornate uterus, included by some under ectopic pregnancy, is considered elsewhere (page 500). Tubal gestation occurs very rarely as a bilateral affection.

A further division as to its site is *primary* and *secondary*. In the former the original implantation of the ovum remains unchanged, while in the latter the ovum, through rupture of the tubes, or other accidents of development, may assume a new location.

Etiology.—A great number of conditions have been held responsible for tubal gestation, through their theoretical ability to obstruct the tube from within or compress it from without and thus cause the arrest of the ovum *in situ*. Gynecologists enumerate among intrauterine causes, chronic salpingitis, chiefly of gonorrheal origin, neoplasms, dislocations, and congenital malformations, especially the so-called persistence of the fetal type of tube. Conditions which compress the tube from without include pelvic adhesions and tumors. But while there is no doubt that in individual cases the presence of some one or more of these factors may be recognizable, the great majority can hardly be thus explained away. The very conditions which prevent the descent of the ovum only too often cause sterility by preventing impregnation. One author, after a careful study of the causation, can see no essential factor to explain the great majority of cases, unless it be the infantile tube which permits of impregnation but favors the arrest of the ovum.

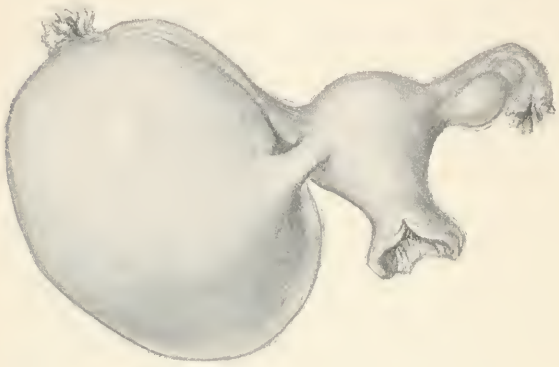


FIG. 490.—OVARIAN PREGNANCY.—(*Martin.**)

Pathology.—This includes changes in the ovum, fetus, and uterus. The gestation sac is formed from the coats of the tube-wall. The muscular tissue, instead of undergoing hypertrophy, often tends to disappear. The sac then eventually consists of connective tissue. Slight peritonitis often coexists and adhesions may form. The attachment of the ovum does not differ radically from that in normal uterine pregnancy. A placenta forms, but the decidual structures are rudimentary; so that the chorionic villi penetrate readily into the gestational sac as far as the peritoneum. This phenomenon, by favoring hemorrhage, tends to favor both abortion and rupture. In regard to the history of the ovum in tubal pregnancy, it may undergo early death in the tube and form a mole; if rupture of the tube occurs, the ovum, expelled into the abdominal cavity, usually perishes, and if very young may be absorbed. In very exceptional cases it may thrive (secondary abdominal pregnancy); if the ovum escapes into the broad ligament (Figs. 492 and 494), death with molar formation results. It is

FIG. 491.—INTERSTITIAL PREGNANCY. RIGHT WALL OF THE UTERUS. FOURTH MONTH.—(*Bumm.*)

* "Ueber Ektop Schwangerschaft," Fig. 1.

commonly stated that in any of these cases death of the ovum may be followed by suppuration, but it is difficult to understand how this could result under the normal sterile conditions which should obtain. If the fetus dies only after reaching an advanced stage of development, some one of various changes noted exceptionally after intrauterine fetal death should develop—calcification, adipoceration, mummification, etc. (page 272). The sac in these conditions may remain quiet for years, perhaps eventually to undergo rupture into any neighboring viscus or cavity.

If the fetus does not die its tendency is toward poor development, and the various deformities and diseases noted in intrauterine fetuses. If it reaches a "viable" stage, it usually dies during its extraction or soon after. Exceptionally survival occurs and the child may be well developed.

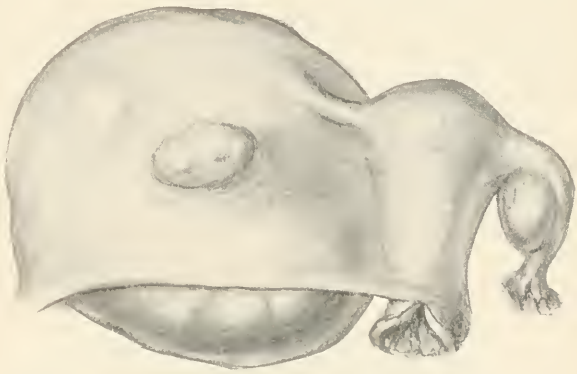


FIG. 492.—INTRALIGAMENTOUS PREGNANCY. LEFT BROAD LIGAMENT.—(*Bumm.*)

The collateral changes in the uterus during ectopic pregnancy are of much interest and are considered under symptoms and diagnosis. They are the same to a certain point as those found in normal pregnancy, even to the formation of a decidua vera (Fig. 495). If the ovum dies these changes are arrested; otherwise they progress, although at a much slower rate than in intrauterine pregnancy. The decidua, however, do not keep pace with the uterus and are usually thrown off at an early period in bits or *en masse*, simulating abortion. Exceptionally they are retained to term, when so-called false labor occurs.

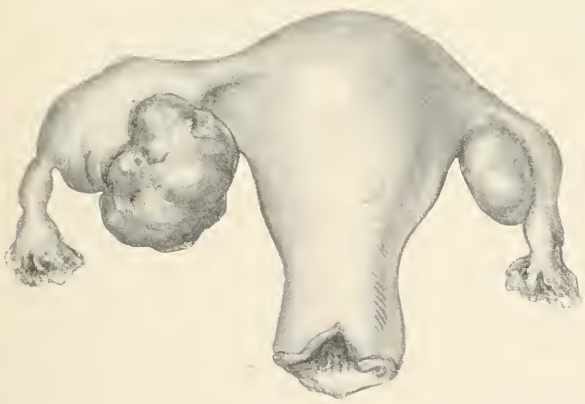


FIG. 493.—TUBAL PREGNANCY. RUPTURE OF THE ISTHMUS OF THE LEFT TUBE AND ESCAPE OF THE OVUM AND BLOOD-CLOTS INTO THE ABDOMINAL CAVITY.—(*Bumm.*)

Symptoms.—Three well-marked phases of tubal pregnancy may be noted clinically. These are: (1) the relatively latent period of early gestation when rupture or abortion does not supervene; (2) the manifestations of rupture and abortion; (3) the period of late gestation in cases which have escaped rupture.

1. Early Quiescent Period.—The quiescence refers to the ovum only, for the patient may present the general and genital symptoms of normal pregnancy. Expulsion of decidual fragments accompanied by hemorrhage internally suggests abortion. Colicky pains in the lower part of the abdomen, and uncon-

nected with expulsion of decidual fragments, are explained by tubal or uterine contractions. Such pains constitute about the only local symptom proceeding from the ovum and its vicinity and are said to be quite common.

II. Interruption of Pregnancy by Rupture or Abortion.—Rupture occurs practically without warning, for any premonitory symptoms are vague in character. The phenomena are those of shock or collapse, marked peritoneal reaction, and at times acute anemia from hemorrhage. The intensity of these symptoms varies with the seat and extent of rupture and the degree of hemorrhage. If the hemorrhage is copious enough, death usually soon supervenes unless laparatomy can be performed; but even after profuse bleeding death is not inevitable, for, as in other similar conditions, spontaneous arrest may occur, although secondary hemorrhage may supervene. A special type of rupture is that which takes place between the folds of the broad ligament. Danger of

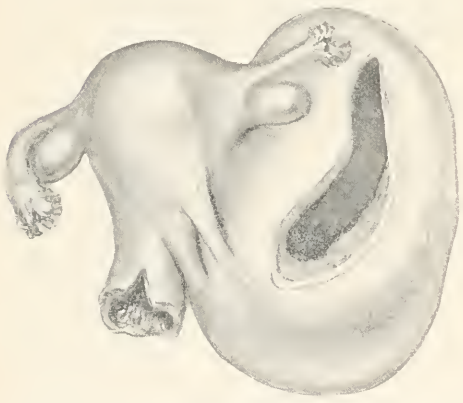


FIG. 494.—BROAD LIGAMENT PREGNANCY.—(*Zweifel.*)

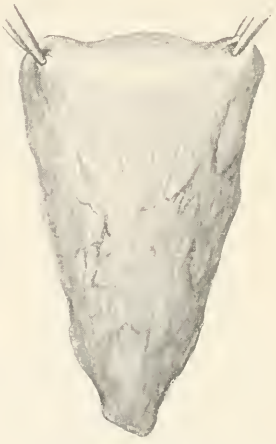


FIG. 495.—UTERINE DECIDUA FROM A CASE OF EXTRAUTERINE PREGNANCY.—(*Zweifel.*)

fatal hemorrhage or collapse is here minimized, and the resulting hematoma causes extreme pain from distention.

When tubal abortion (Fig. 496) occurs the accompanying hemorrhage into the fetal sac may give rise to subjective symptoms which resemble those of rupture but in a much milder degree. Abortion is now believed to be the common termination of tubal pregnancy, and as the escape of blood may extend over a long period, a large hematosalpinx forms and blood also drains into the peritoneal cavity with formation of a pelvic hematocele.

In tubal abortion and in mild degrees of rupture with fetal death, the constitutional symptoms of impregnation naturally disappear.

Rupture usually occurs during the second and third months.

III. Latter Half of Gestation.—There is not much to be said here. The phenomena chiefly resemble those of normal pregnancy, false labor so called setting in at term or before; exceptionally a little later. Left to itself, the fetus perishes during false labor. The uterus in ectopic pregnancy often continues to be the source of apparent menstruation, expulsion of decidual fragments, etc. This with the asymmetric appearance of the abdomen, and the

superficial position of the fetus, constitute the leading symptoms of the later months in tubal pregnancy.

Diagnosis.—The subjective and constitutional phenomena of the different stages of tubal gestation have been outlined in the preceding section. There remains to be considered the objective and induced symptoms upon which the diagnosis must chiefly be based.

During the early quiescent period when there are no pathognomonic symptoms for differentiating ordinary pregnancy, an enlarged Fallopian tube may be made out by careful bimanual examination; and the decidual character of the fragments which escape from the uterus in some cases may be recognized by the microscope. Naturally the fear of disturbing a normal pregnancy and of rupturing an impregnated tube militates against a vigorous physical examination. As a matter of fact, a diagnosis is seldom made during the early months; only after an early termination of pregnancy by rupture or abortion, or after the cumulation of symptoms of an atypical gestation, is the condition usually

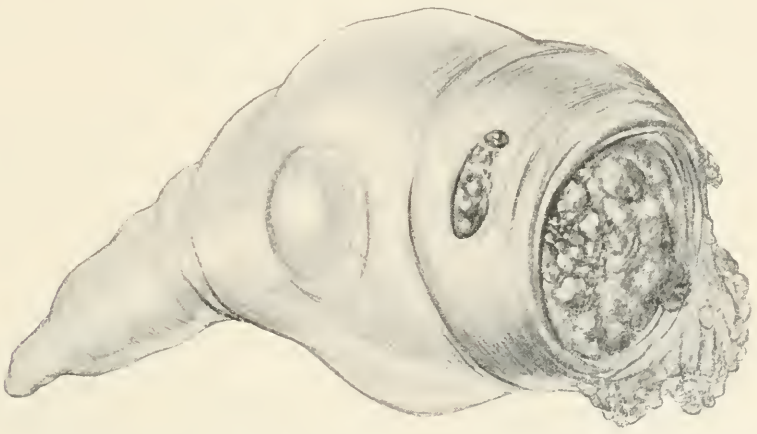


FIG. 496.—TUBAL ABORTION, OVUM BEING EXTRUDED THROUGH THE FIMBRIATED EXTREMITY OF THE TUBE.—(*Kelly.*) × 1.

recognized. In a suspected case a history of prolonged sterility is of some collateral value.

When rupture or abortion has evidently occurred, bimanual examination reveals the presence of blood in Douglas's sac, in addition to the enlarged pregnant tube, the size of which may be abnormally increased by the supervention of a hematosalpinx. Naturally in profuse hemorrhage with impending death the diagnosis is established by the resulting laparotomy. In hemorrhage into the folds of the broad ligament the peculiar character and seat of the tumor are recognized by palpation through the vagina and rectum and from without.

In the latter half of gestation diagnosis is made by mapping out the sac and the uterus itself, which while enlarged seldom exceeds even at term the size of the normal impregnated organ at four months. The abnormal location of the fetus is made out by auscultation of heart-sounds, ballottement, and in general the measures in use for determining the fetal position in normal pregnancy. (For the complications of normal with ectopic pregnancy see page 136.)

Treatment.—There is no medical treatment for ectopic pregnancy, nor any palliative or temporizing management; for the right of the child to be born

alive does not enter into the question. During the early quiescent period when the condition is strongly suspected, or when, during laparotomy, etc., the condition is accidentally discovered, the tube should be extirpated. The ovary may be let alone, treated conservatively, or extirpated along with the tube, according to its condition.

After the diagnosis of rupture or abortion is made, a radical operation is at once indicated, irrespective of the severity of the hemorrhage. When great loss of blood has occurred, or is still taking place, saline infusion (intravenous) is begun with the operation and continued during and after. In certain cases in which hemorrhage appears to have ceased, it is of some advantage to allow the patient to recover from slow collapse before anesthetizing. It is well to postpone saline infusion, however, until the moment of operating. If the patient has naturally rallied from the hemorrhage and shock to such an extent that she is out of immediate danger, it is still best to interpose at once lest secondary hemorrhage occur.

Tubal Abortion.—Laparotomy is performed in the Trendelenburg position. The tube is first clamped and then ligated and both ends are removed. Escaped blood, clots, fetal tissue, etc., in the peritoneal cavity should be removed by sponging. In hematoma of the broad ligament the latter must be incised and evacuated, the wound being closed with buried sutures.

After gestation has progressed beyond the period of rupture and abortion, diagnosis must be followed by extirpation of the sac as a whole, or of its contents. The first is practicable only up to a certain period, viz., before the establishment of the placental condition, or prior to the end of the fourth month. This is essentially readily accomplished by the ordinary operation of salpingectomy with additional precaution as to hemostasis.

After this period the danger of hemorrhage is too great to permit of attempting the removal of the sac *en masse* and a modified operation is recommended. The sac is incised and the fetus removed, the cord being afterward ligated close to the placenta. The incision is then sutured to the external wound and packed with aseptic gauze, after careful cleansing with the saline solution. A glass drain replaces the packing at the end of forty-eight hours, and remains until the complete obliteration of the sac. During this period the placental circulation is slowly arrested and the placenta itself generally comes away in fragments. If the fetus is dead, either recently or after a long interval, this precaution is not necessary, as the entire contents of the sac may be removed, including all fetal tissue.

XXI. PREGNANCY IN ONE HORN OF A UTERUS BICORNIS OR UNICORNIS; CORNUAL PREGNANCY.

Cornual pregnancy is the development of an ovum in one horn of a two-horned uterus or in one side of a double uterus (Figs. 497 and 498). Fortunately the condition is rare, for women with malformations of the uterus are

FIG. 497.—PREGNANCY IN THE RUDIMENTARY HORN OF A UTERUS UNICORNIS. The rudimentary horn is shut off from the uterine cavity. The corpus luteum was found in the ovary of the opposite side; hence intraperitoneal transmigration of the ovum occurred.—(*Howard Kelly.*)

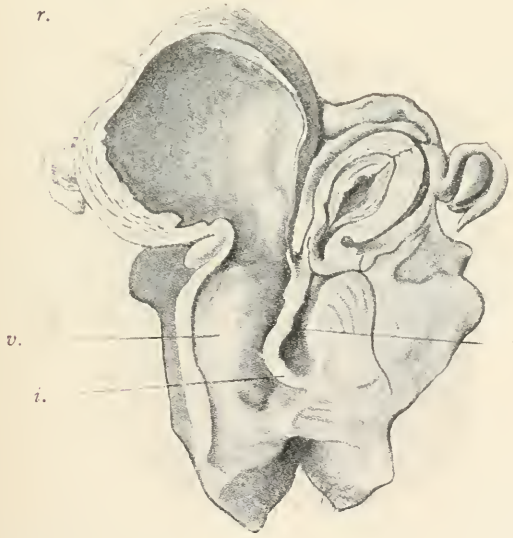


FIG. 498.—UTERUS DUPLEX BICORNIS, WITH A VAGINA SEPTA. The right uterus contained the product of conception and was $6\frac{3}{4}$ inches (17 cm.) long; the left uterus was filled with decidua alone and was $4\frac{3}{4}$ inches (12 cm.) long. *r*, Right uterus; *v*, right vagina; *i*, intervaginal septum.—(*Nagel.**)

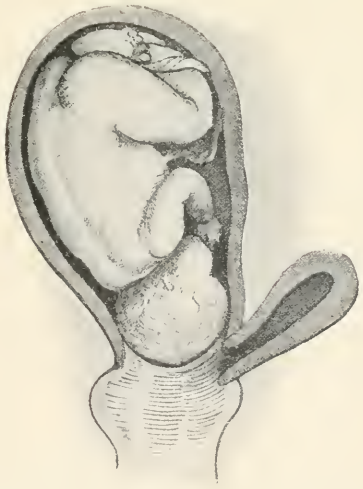


FIG. 499.—PREGNANCY WITH A UTERUS DUPLEX † The unimpregnated part caused an obstruction to labor.

* Veit's "Handbuch d. Gyn.," Bd. I, Fig. 119.

† "Zeitsch. f. Geb. u. Gyn.," Bd. XIV, S. 169.

subject to more complications during both pregnancy and labor than when the uterus is normal; they are more easily infected and fatal terminations are common. If the horn is well developed, delivery may be normal; but if the horn is rudimentary and there is no normal communication with the lower genital tract, the condition resulting is markedly like ectopic pregnancy (Figs. 501 and 502). The symptoms, course, and treatment are then practically the same as in ectopic pregnancy. Kehrer, who collected and analyzed 82 cases

FIG. 500.—PREGNANCY IN AN UNDEVELOPED HORN OF A UTERUS BICORNIS.—(*Werth.**)

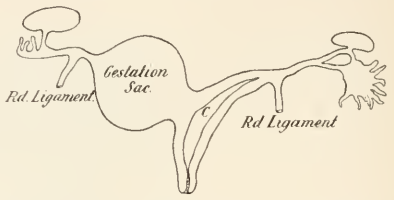


FIG. 501.—PREGNANCY IN A RUDIMENTARY HORN OF A UTERUS, SHOWING THE RELATION OF THE ROUND LIGAMENT TO THE GESTATION SAC. THE SAC IS INSIDE OF THE ROUND LIGAMENT.—(*Dakin.*)

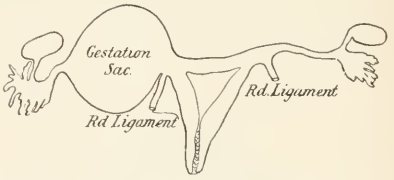


FIG. 502.—RELATIONS OF THE SAC OF A TUBAL PREGNANCY TO THE ROUND LIGAMENT. THE SAC IS OUTSIDE OF THE ROUND LIGAMENT.—(*Dakin.*)

from literature in 1900, states that expectancy is never indicated. Intervention should always be by Cæsarean section after the thirty-second week. In Kehrer's study all the cases of labor in uterus duplex (Fig. 499) are recorded. The great majority are divided about equally between uterus unicornis bicollis and uterus bicornis unicollis (Fig. 497). A few cases occurred in uterus bicornis duplex (Fig. 499) and uterus septus bilocularis, but none whatever in any other varieties.

XXII. MISSED LABOR.

At full term ineffectual labor sets in, subsides, and the uterus remains unemptied for months or even years; occasionally simple prolongation of pregnancy, without any onset of labor occurs. A like condition is that of "missed abortion," when the fetus dies in the early months of gestation and remains in the uterus for weeks or months.

Etiology.—This is obscure; some variety of obstructed labor is usually present, such as tumors of the soft parts, exostoses or tumors of the bony pelvis, con-

* "Arch. f. Gyn.," Bd. XVII, S. 281.

tracted pelvis, cancer of the uterus, cicatricial bands of the cervix or vagina. The possibility of ectopic gestation, or of pregnancy in one horn of a bicornuate or unicornuate uterus, must be remembered (see pages 361, 367).

Terminations.—The fetus always dies, and one of the following changes occurs: (1) maceration of soft parts and prolonged discharge from the cervix, with retention of the bones (page 305); (2) ulceration through the uterine wall into the vagina, rectum, or abdominal cavity; (3) septic metritis and fatal septicemia; (4) mummification; (5) calcification; (6) adipoceration; (7) putrefaction. (Compare Death of the Fetus, page 272.)

Treatment.—No pregnancy should be allowed to continue more than two weeks past the normal period of gestation, without a thorough examination as to the cause, with the aid of an anesthetic, if necessary. The treatment will depend upon the findings in this examination. If pregnancy be normal, labor should be at once induced; if ectopic or cornual, treatment should be along the lines laid down for those conditions. In cases in which weeks or months have elapsed and maceration or putrefaction of the fetus has occurred, in intrauterine pregnancy, the uterus should be emptied with all antiseptic precautions, and in cases of uterine sepsis or perforation, hysterectomy is advisable.

XXIII. SUDDEN DEATH IN PREGNANCY.

Sudden death, directly attributable to pregnancy, appears, with few exceptions, to be an impossibility; although the state of gestation is naturally able to influence unfavorably the prognosis of many serious affections, and thus to bring about sudden death indirectly, as in the case of cardiac valvular disease. Further, there are sudden affections which, while not peculiar to pregnancy, appear to be determined by the latter and may lead up to sudden death (acute yellow atrophy of the liver, impetigo herpetiformis). Finally, pregnancy does not appear to afford any immunity to sudden deaths from common causes, and the pregnant woman succumbs to apoplexy and the like, just as does the non-pregnant. Sudden death, absolutely referable to the pregnant state, could come only from eclampsia before delivery; from some mechanical result of the crowding of the viscera by the enlarged uterus (internal intestinal strangulation, etc.); from attempts at abortion, including the use of poisons; and, finally, from operative intervention.

XXIV. INJURIES TO AND OPERATIONS UPON PREGNANT WOMEN.

Injuries and Accidents.—Severe injuries do not necessarily result in a premature interruption of pregnancy. The more common are those which cause a rupture of an enlarged blood-vessel of the external genitals or of the lower extremities. In a distended and varicose condition of the vessels of the vulva, the rupture of these vessels, owing to a fall from a bicycle, has resulted in almost fatal hemorrhage. In a case in private practice, I almost lost a patient from this cause; pregnancy was not disturbed. Many instances are recorded of the mother sustaining severe injuries by blows and falls, without pregnancy being interrupted. The abdomen itself has been torn open, and the fetus has even sustained fractures and traumata, and pregnancy has con-

tinued. Extensive general burns, and severe local bruises and injuries of the vulva and pelvic floor, have not interfered with pregnancy. Spontaneous rupture of the uterus is one of the rarest accidents, and may be due to traumatism, overdistention, a previous Cæsarean section, or chronic inflammation. Again, traumatism may be an exciting cause of rupture, in the presence of hydramnios, chronic inflammation of the uterus, or weakening of the uterine walls by a previous hysterectomy.

Penetrating Wounds of the Gravid Uterus.—This lesion is of very rare occurrence. In 1899 * Estor and Pruech could find notes of but 40 cases in literature. The wounds were inflicted by cutting or pointed instruments, projectiles, the horns of animals, etc., and could be divided into incomplete, complete, and complicated. In the first-named the uterine wall was not completely penetrated. Complete penetration has been extensive enough to permit the escape of the cord or even the fetus itself. In the complicated type other abdominal viscera were also wounded. The symptoms are those of shock and hemorrhage with pain, escape of amniotic fluid, and prolapse of some of the contents of the uterus. Peritonitis resulted in a certain proportion of cases. About 25 per cent. of the cases were fatal from shock, hemorrhage, or peritonitis. The complicated wounds have necessarily a graver prognosis. Laparotomy may be necessary for diagnosis, and certainly will be required for rational treatment with or without hysterectomy.

Operations.—Surgical operations upon pregnant women are not only justifiable, but demanded, when delay until after confinement would seriously jeopardize the health or life of the patient. Under ordinary circumstances there is little danger of interrupting the pregnancy. Women of great nervous irritability will sometimes prove the exception to the rule. The irritation produced by ulceration at the root of a tooth is usually more liable to interrupt a pregnancy than the administration of nitrous oxide gas and the removal of the tooth, or the establishment of free drainage. The author has repeatedly had gas administered to patients for this purpose, and has never seen any bad results. Fibroid tumors, ovarian cysts, and the appendix are now frequently removed, without interrupting pregnancy, and for numerous other causes the abdomen has been opened and pregnancy has continued. Operations should not be performed at a period corresponding with the menstrual epoch, as abortion is then more apt to occur. For the same reason, it will be well to avoid the third, fourth, and eighth months. My opinion is that anesthetics in pregnancy are rather favorable than otherwise in their influence, when they decrease reflex irritation.

XXV. PREGNANCY AFTER OPERATIONS INVOLVING THE GENITALS; PREGNANCY AFTER VENTROFIXATION AND VENTROSUSPENSION.

See Pathology of Labor, Part V.

XXVI. FEVER OF PREGNANCY.

This peculiar affection has been described by a number of authorities, including Tarnier and Ahlfeld. It occurs in two types, acute and subacute

* "Rev. de gynécol.," Nov., Dec., 1899.

or chronic, which differ radically, and are held to be entirely separate conditions. Acute fever of pregnancy resembles such conditions as typhoid fever, septicemia, and acute miliary tuberculosis. Chronic fever of pregnancy appears to be a neurosis, with participation of the heat-center. Clinically it has been likened to a confirmed phthisis. From the facts that these febrile affections supervene without the least apparent cause, and subside immediately after the uterus is evacuated, they have received the designation "fever of pregnancy." On account of the serious character of the symptoms, abortion has been performed a number of times. Had the correct diagnosis been made, no intervention would have resulted. Kleinwächter is opposed to the use of the term "fever of pregnancy," or including the condition among the indications for terminating pregnancy.

XXVII. THE METRORRHAGIA OF PREGNANCY; ANTE-PARTUM HEMORRHAGE.

A discharge of blood from the vagina during pregnancy naturally suggests threatened or inevitable abortion (Fig. 504), or placenta prævia, and should

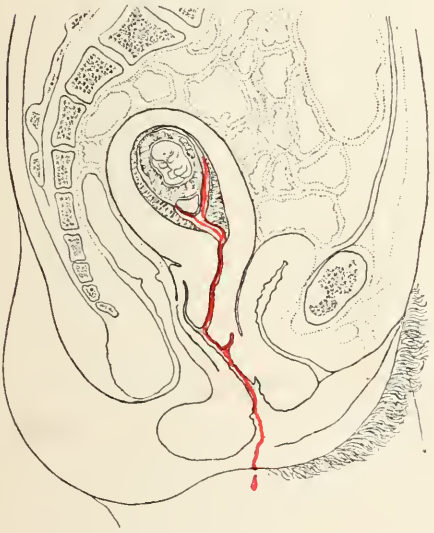


FIG. 503.—THE METRORRHAGIA OF PREGNANCY. MENSTRUATION OCCURRING IN THE EARLY WEEKS.

FIG. 504.—THE METRORRHAGIA OF PREGNANCY. Hemorrhage caused by the separation of the decidua vera from the uterine wall in threatened or inevitable early abortion.

always receive careful attention. There are various other causes of hemorrhage, however, which should not be forgotten. They will be discussed here chiefly with reference to the diagnosis; the treatment, when of obstetric importance, being considered elsewhere. (1) In *cervical endometritis*, or cervical catarrh, the vaginal mucus may be stained with blood, but the amount is usually slight; the cervix will be found larger than normal, with perhaps pouting of the lips, erosions of the mucous membrane, and follicular degeneration; the outer lips of the ex-

ternal os having a velvety feeling. There is follicular degeneration, and little nodules, like shot, can be felt by the examining finger. (2) In *eroded cervix*, or cervical erosions so called, there are patches of bright red, granular mucous membrane, which were formerly erroneously supposed to be ulcers; they readily bleed upon pressure. (3) With *lacerated and eroded cervix*, the infection of a cervical tear is a common cause of cervical endometritis. In these cases there will be considerable cervical hypertrophy, with the other evidences of cervical inflammation. (4) *Persistence of menstruation* is a rare condition. In many of the recorded cases, the hemorrhage has been probably due to placenta prævia or other causes. The diagnosis must rest on the monthly occurrence of the flow and upon the exclusion of other sources of hemorrhage (Fig. 503). (5) *Hemorrhoids of the vagina*, ostium vaginæ, or vulva have already been discussed. In rare instances, and usually as the result of traumatism, rupture may occur, giving rise to severe hemorrhage, which requires suture. The diagnosis is made by inspection. (6) Hemorrhage may be due to separation of a *placenta prævia*, or of a *normally situated placenta* (see pages 214 and 224) (Fig. 505). (7) An *intracervical polyp* sometimes occurs as a complication of gestation, and causes persistent hemorrhage; the diagnosis is made by inspection. If there is much protrusion of the polypus the diagnosis will not be difficult. In some cases, however, it is very likely to be confounded with abortion, the polypus being mistaken for the intact ovum. The history of the case before pregnancy may be of assistance. (8) *Cancer of the cervix* may be a cause of hemorrhage during pregnancy, and has been mistaken for placenta prævia. The diagnosis will rest upon the characteristic cauliflower appearance, when it is present; upon the fetid discharge; and upon the exclusion of other sources of hemorrhage, such as placenta prævia, cervical erosions, and cervical polypus. The diagnosis must, of course, be confirmed by microscopic examination. (9) *Malignant disease of the vagina* is not common, and when it does occur is usually secondary to cancer of the cervix. Hemorrhage and a foul-smelling discharge are common symptoms. There may be a papillary swelling of the posterior wall, or the vaginal walls may be generally infiltrated and the vagina constricted. The inguinal glands are usually infiltrated. (10) *Apoplexy of the placenta* has already been discussed; if slight hemorrhage occurs and placental apoplexy is suspected, the treatment is, of course, that of threatened abortion (see page 357).

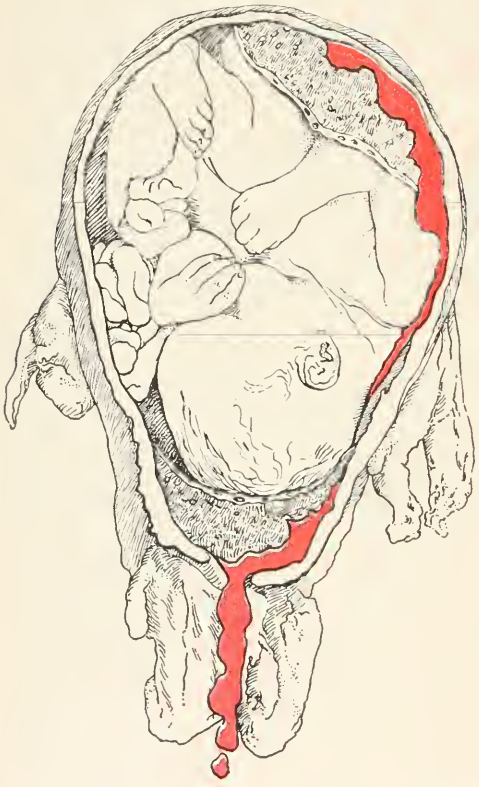


FIG. 505.—THE METRORRHAGIA OF PREGNANCY. Internal concealed hemorrhage from the separation of a normally situated placenta, and also hemorrhage from the separation of a central placenta prævia.

PART FOUR.

Physiological Labor.

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Labor is the physiological end of pregnancy, and may be defined as the process by which the fetus and its appendages are separated from the mother. All labors are classified as either normal or abnormal, or, as they are here designated, physiological and pathological labors. Normal or physiological labor is the delivery of a living child with the vertex presenting, by the natural forces, and without complication in any of the three stages. Should the fetus be still-born, its death having occurred either just previous to or during the labor, but not being directly due to the labor, the labor would still be within the limits of normal. Vertex presentation is the most frequent, it gives the lowest mortality rate, and labor is more easily and quickly terminated by this than by any other presentation. The three factors concerned in any variety of labor are: (1) the passages; (2) the fetus; (3) the forces.

I. THE PASSAGES.

1. THE BONY PELVIS.

Introduction and Definitions.—A knowledge of the female bony pelvis is the very alphabet of obstetric science and the foundation of obstetric art. This structure is most important, since it is from the disproportion between its size and that of the fetus or from its abnormal shape that many of the difficulties during labor arise. The derivation of the term is from the Greek word πελίς, "a bowl," from its fancied resemblance to that ancient utensil once used by barbers; or it may be because it plays the part of a reservoir for certain temporary secretions. It is that part of the trunk which forms the lower abdominal boundary, and in the adult it is situated near the middle of the body. It transmits to the lower extremities the weight which it receives from the head and the rest of the trunk; it is supported anteriorly by the femora; it is open above and below and is a bony, irregular, roomy, and conoidal shaped cavity or canal. The anatomical pelvis is composed of four bones: the two ossa innominata, the sacrum, and the coccyx. The obstetric pelvis includes, besides these bones just mentioned, the last lumbar vertebra. This description designates the static pelvis, but there are other parts to be considered in the dynamic pelvis—that seen in the living subject and in labor. These are the soft parts which form its floor and extend the parturient canal. It will be seen from this statement that the obstetrician must recognize and be familiar with two pelves, the one bony and stable, the other soft and pliable. The former is passive, the latter active. The most important parts of the pelvis, obstetrically, are the inlet and the outlet.

The Bones (Ossa Innominata, Sacrum, Coccyx).—The anterior and lateral walls of the pelvis are formed by the ossa innominata. Each os innominatum or hip-bone is shaped like a stretched-out quadrangle, constricted and twisted in the middle, by which means the two parts of the bone are brought into different planes (Fig. 506). The *hip-bone* is composed of: (1) the ilium; (2) the

ischium; (3) the pubis. It is not till the eighteenth or twentieth year that the several parts of the acetabulum are firmly joined. A faint white line marks the junctions. The *sacrum* forms the larger part of the posterior pelvic wall. It is shaped like a pyramid with the base at the upper part, and is composed of four vertebræ. The term is derived from *sacer*, "sacred," because it helps protect the genitals, which were held to be sacred, or because it was offered in sacrifice. The *coccyx*—so named because it was thought to look like the cuckoo's beak—comprises five rudimentary vertebræ. It is shaped like a triangle and has its base pointing upward. If a bony union is established between the sacrum and coccyx, it may offer an obstacle to labor; normally

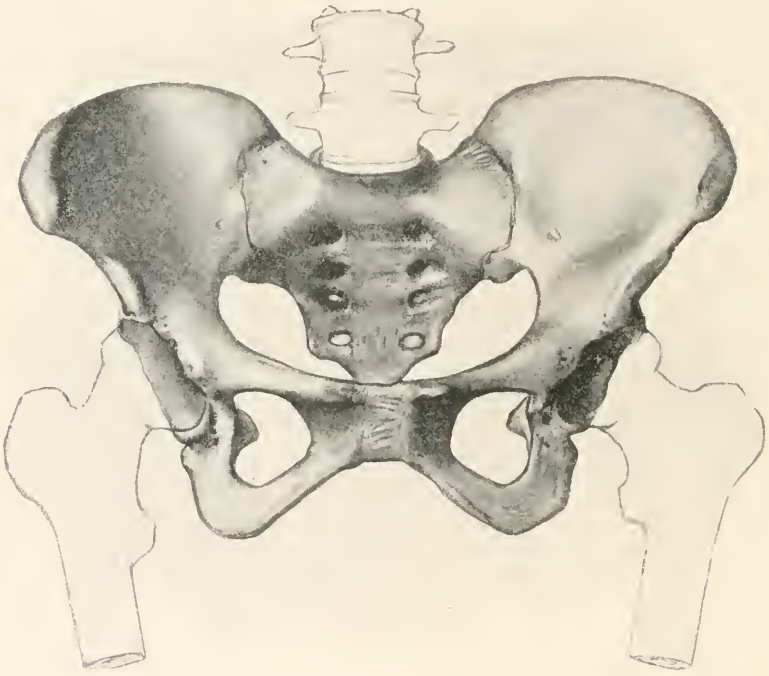

FIG. 506.—FEMALE BONY PELVIS.

the coccyx remains movable until middle life. It represents the tail appendage in vertebrates.

The Pelvic Joints.—By their existence the pelvis is possessed of a certain amount of mobility between its several parts. These articulations number seven—one pubic, two sacro-iliac, three sacro-lumbar, and one sacro-coccygeal. Five of these articulations are amphiarthrodial, much like those between the bodies of the vertebræ.

Pubic Joint or Symphysis Pubis.—The pubic joint or "symphysis" possesses fibro-cartilages similar to the intervertebral discs, each of which is firmly attached to the corresponding pubic bone. This cartilage is soft in the center and firmer at the outside; thicker in front than behind, and thicker in females than in males. Many assert the presence of a synovial membrane,* though Morris, Depaul, and French authorities generally deny its existence save in

* Allen.

exceptional cases. There are, besides, four ligaments—a posterior, a superior, an anterior, and an inferior sub-pubic or ligamentum arcuatum. By the last the pubic arch is filled out and made smooth and rounded (Fig. 510). In the pregnant woman the symphysis together with the other joints becomes more movable. The softening of pregnancy gives rise to a slight gliding movement. The connected surfaces are practically not separated, as, indeed, this separation would have to be considerable to increase the antero-posterior diameters to any extent.

Following the investigations of Budin, I have made examinations of several hundreds of pregnant women in three maternity services, over a period of ten years, in order to ascertain if there were movements in the pubic articulation. The ball of the finger was placed directly against the lower margin of

FIG. 507.—MALE BONY PELVIS.

the symphysis pubis, and then the woman was asked to walk or stand first on one and then the other leg. The side of the pubis corresponding to the free leg was found to descend, while the bone on the other side remained fixed. I concluded that there is invariably present in this joint a certain amount of mobility which increases with the advance of pregnancy and with the number of pregnancies, and when present to a considerable degree the subjects have no difficulty in walking; the mobility is very slight in primigravidæ. (See page 114.)

Sacro-iliac Joints.—The sacro-iliac articulation joins the lateral surfaces of the sacrum and ilium. Some anatomists, among whom is Luschka, believe that there is a synovial membrane, especially marked in pregnancy. Morris does not hold this view; at least he does not believe the synovial membrane to be constant, although it is more apt to be present in the female than in the male. There are,

besides, six ligaments to make the joint firm. In normal labor the only movement worthy of mention in these joints is a gliding one, and by it the antero-posterior diameter of the pelvic outlet is somewhat increased. In five symphyseotomies I obtained from two to two and a half inches separation at the pubis, and subsequent strong fibrous union in each case without apparent injury to the ligaments of the sacro-iliac joints. This proves the existence of a certain amount of motion at these joints, and also of considerable stretching of the anterior ligaments.

I believe that the movements taking place in the sacro-iliac joints during labor are important to its progress. There is an elevation and depression of the pubis, or diminution and increase of pelvic inclination; or, from another point of view, if the sacrum is considered as the bone that moves, it oscillates in an imaginary transverse axis which passes through the lower part of the second sacral vertebra, so as to increase the pelvic inlet or outlet.

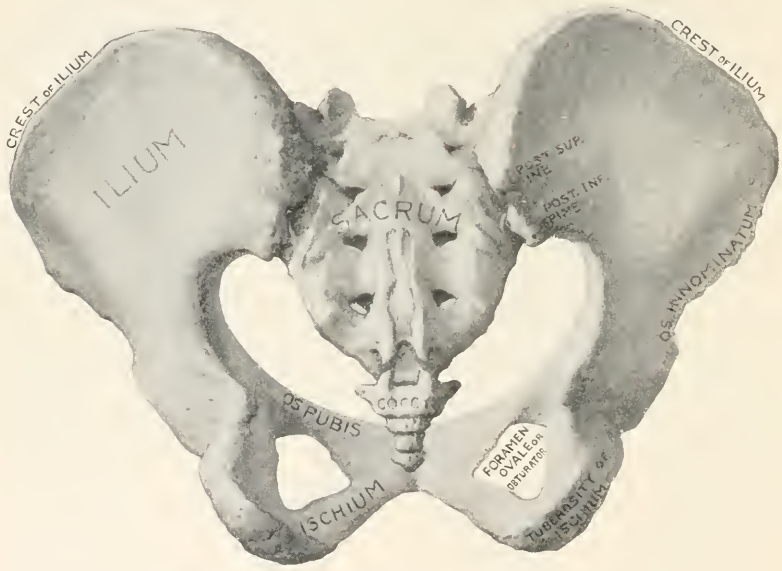

FIG. 508.—POSTERIOR VIEW OF FEMALE BONY PELVIS.

Sacro-vertebral Articulation.—The union between the sacrum and the last lower lumbar vertebra is like that between the other vertebræ. The peculiarity of this joint is that the interarticular disc of cartilage is just twice as thick in front as behind, thus forming what is termed the "sacro-vertebral angle" (Fig. 511). The "pelvic inclination," while it depends in a great measure upon the angle thus formed, yet is produced in part also by the obliquity of the innominate bones to the sacrum. The union between the vertebral bodies is amphiarthrodial, while that between the apophyses is arthrodial.

Sacro-coccygeal Joint.—The most movable joint is the sacro-coccygeal joint, and is considered a part of the pelvic floor. It has two articular surfaces, an interosseous fibro-cartilage, and four peripheral ligaments. Firm union between the coccyx and sacrum occasionally occurs even in young subjects, but is most often found in elderly primiparæ. Generally, however, during the exit of the

head the coccyx is pushed back, and by this means the antero-posterior diameter of the outlet is increased to the extent of one inch.

Functions of the Pelvic Joints.—In an obstetric sense the pelvic joints are designed by nature not so much to increase the diameters of the pelvis by

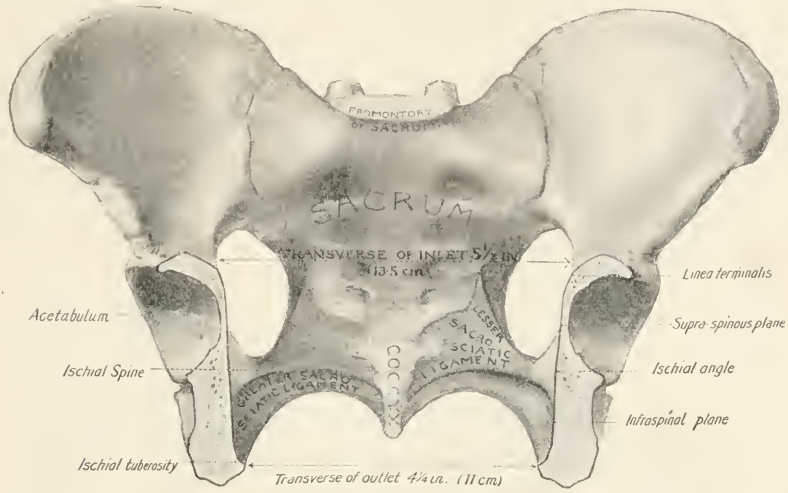

FIG. 509.—TRANSVERSE SECTION THROUGH THE ACETABULA AND ISCHIAL TUBEROSITIES, SHOWING POSTERIOR PORTION OF THE INTERNAL SURFACES OF THE FALSE AND TRUE PELVIS.

the swelling they undergo in pregnancy and by the slight movements occurring in them as they are to act as cushions to lessen jars and shocks that might be transmitted to the spinal cord, uterus, or fetus, from blows, falls, and traumatisms in general. The greatest mobility is exerted at the sacro-coccygeal joint, less at the pubic, and least at the sacro-iliac. The sacrum can move in an antero-posterior diameter, making a swing of 1 cm. for the promontory. This is most marked when the woman is on her back with her legs hanging over the edge of the table, the attitude known as "Walcher's hanging position." (See Part X, Posture in Obstetrics.)

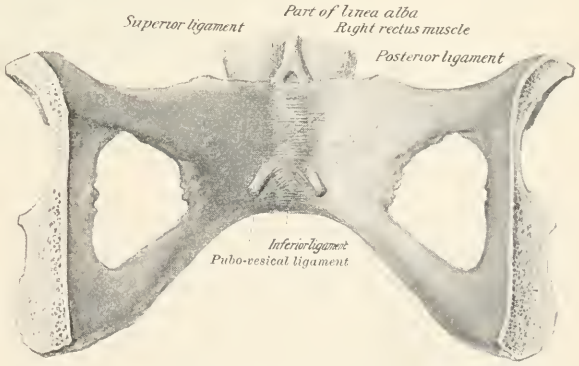

FIG. 510.—ANTERIOR PORTION OF THE INTERNAL SURFACE OF THE PELVIS.

Internal Surface of the Pelvis.—The bony pelvis may be regarded as a cylinder, contracted near its middle by the circumference of the pelvic inlet, which divides it into a *false pelvis* above and a *true pelvis* below. In contrast to the rough and irregular external surface, the internal surface of the pelvis is smooth and symmetrical, and is clearly divided into the two parts mentioned above. The cavity of the pelvis may be considered to be an inverted,

truncated cone. The dividing-line consists of the ilio-pectineal line, supplemented by the superior anterior margin of the sacrum and its alæ, or the boundary-line is the circumference of the pelvic inlet (Fig. 509).

The False Pelvis.—The false, superior, or large pelvis is bounded behind by the last lumbar vertebra and the ilio-lumbar ligaments; on the sides by the iliac bones; in front there is a gap filled up in the recent state by the elastic lower abdominal wall. If the convergence of the bony walls of the false pelvis were continued downward, they would meet at a point corresponding with the fourth sacral vertebra. It is from this fact that the false pelvis has often been compared to a funnel. The false pelvis really belongs to the abdominal cavity, and to its contents it offers protection and support; it has no marked obstetric value. In multigravidous women the iliac fossa serves to support the fetal head. It forms an inclined plane which serves as a guide to the fetus and

FIG. 511.—SAGITTAL SECTION THROUGH THE MIDDLE OF THE SACRUM AND PUBIC JOINT SHOWING THE INTERNAL LATERAL SURFACES OF THE FALSE AND TRUE PELVIS.—(*From the author's aluminium cast of a female pelvis.*)

directs it downward when impelled by contractions of the uterus, and thus aids its engagement in the pelvic inlet; and not unless it be very much deformed will it obstruct the passage of the child.

False Pelvis and External Measurements.—(See Pelvimetry, page 163.)

The True Pelvis.—The true, inferior, or small pelvis is that part below the ilio-pectineal line, and it forms the true obstetric pelvis (Fig. 509). The true pelvis in the female is much larger than that in the male. It is bounded posteriorly by the concavity of the sacrum; on the sides by the sacro-sciatic ligaments and the internal surfaces of the acetabula and obturator membranes; anteriorly, by the pubic bones and obturator membranes. If any horizontal plane of this curved cylinder—the true pelvis—is taken at a level, the bony wall is incomplete. In any plane that may be selected there will be a foramen covered by membrane or by distensible and elastic muscular or fibrous tissue;

or a movable joint such as the coccyx directly opposite the solid mass of the pubic bones; or some elastic tissue that will permit of considerable compression without injury. The conclusion to be drawn from this fact is that although the fetus must pass through this bony cylinder to reach the external world, yet by the peculiar formation of the pelvis both the fetus and the mother's soft parts are protected against too great or too prolonged pressure; while if concussions should occur, their effect would be much alleviated.

The Pelvic Inlet.—The pelvic inlet, superior strait, brim, margin, isthmus, linea terminale, linea ilio-pectinea, is the entrance to the cavity of the true pelvis. The superior strait and the inferior strait received their names because they were thought to be more contracted than the space which lies between them. I prefer the term pelvic inlet. The *anatomical inlet* is the entrance of the small or true pelvis, and corresponds to the upper margin of the symphysis pubis, and to the edges of the bones extending backward to the sacral promontory (Fig. 513). The *obstetric inlet* is the least available space at the upper portion of the pelvic canal; it is bounded by a line passing $\frac{2}{5}$ inch (1 cm.) below the upper margin of the symphysis pubis, along the posterior margin of the oblique rami and body of the pubis, past the ilio-pectineal eminences, the anterior margin of the sacral alæ, and the summit of the sacral promontory.

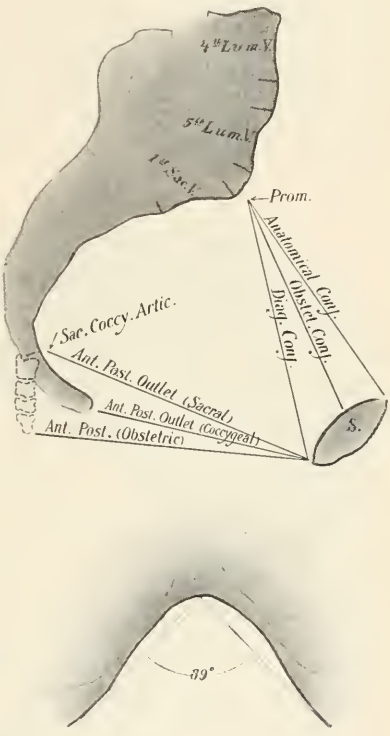

FIG. 512.—VERTICAL MESIAL SECTION OF A FEMALE PELVIS SHOWING THE LUMBO-SACRO-COCCYGEAL CURVE, THE INCLINATION AND SHAPE OF THE SYMPHYSIS, THE RELATIONS OF THE ANATOMICAL, OBSTETRIC, AND DIAGONAL DIAMETERS OF THE PELVIC INLET, AND THE SACRO-PUBIC and COCCYGO-PUBIC DIAMETERS OF THE PELVIC OUTLET. THE LOWER FIGURE SHOWS THE PUBIC ARCH.—(*From the author's lead-tape tracings.*)

Shape.—The shape of the inlet in the bony pelvis is that of a curvilinear triangle with the base behind and the apex in front, the chief irregularity being found in the sacral promontory. It is here that pelvic deformities cause by far the greatest trouble, and hence an intimate knowledge of the pelvic inlet is necessary (Fig. 513).

Pelvic Inlet Measurements.—(See Pelvimetry, page 167.) The circumference of the pelvic inlet is 16 inches (40.5 cm.).

Obstetric Landmarks of the Inlet.—(1) The symphysis pubis in front; (2) just posterior on either side, situated upon the pubic bone, close to the ilio-pubic junction, is found a rough eminence—the ilio-pectineal eminence; (3) the boundary-line of the inlet on either side, known as the linea terminalis; or more commonly, from its source of origin, as the ilio-pectineal line; (4) the points on the sacro-iliac joints at which the linea pectinea joins them; (5) the promontory of the sacrum or the sacro-vertebral angle. The intervertebral cartilage between the sacrum and last lumbar, being wedge-shaped and thicker in front, forms an angle between the sacrum and vertebral column and causes the inclination of the pelvis.

The Pelvic Cavity.—The pelvic cavity, pelvic canal, excavation, small or true pelvis, is the portion bounded by the inlet above, the outlet below, in front by the symphysis pubis, at the sides by the innominate bones, and behind by the hollow of the sacrum and the coccyx. The pelvic cavity is irregularly barrel-shaped or cylindrical. It must never be forgotten that the pelvis offers a curved and not a straight cylinder to deal with—a cylinder bent upon itself, so to speak. If this fact be overlooked, the most important factor in determining the mechanism of delivery is ignored. This cavity may be conveniently separated into four regions: anterior, posterior, and two lateral (Figs. 509 to 511). The anterior region has a marked notch in the pubic arch. The surface is convex from above downward, and concave from side to side. In the middle of this region the posterior part of the articulation of the symphysis

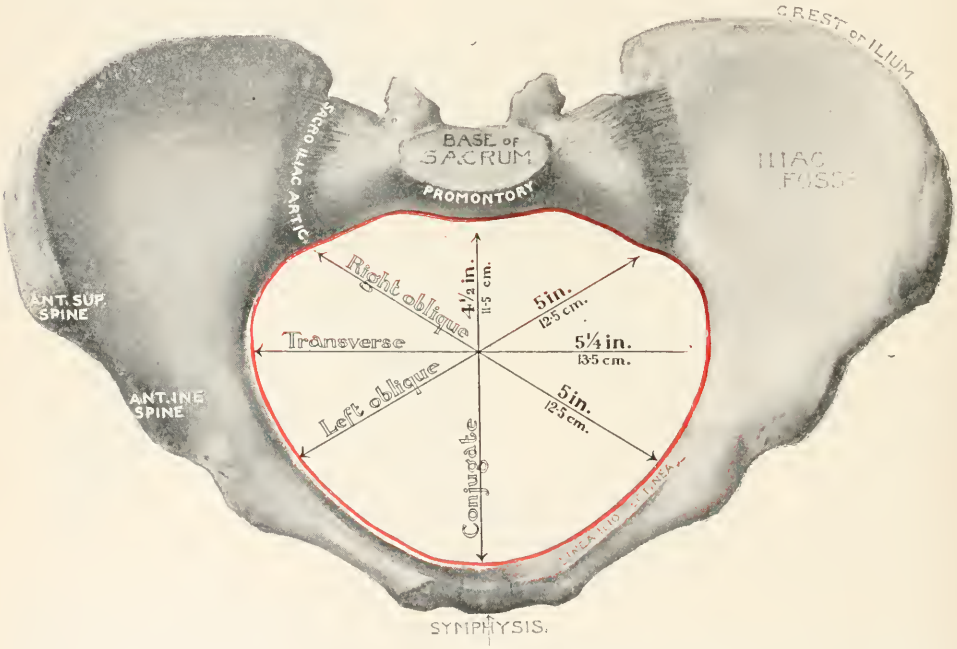

FIG. 513.—THE SUPERIOR SURFACE OF THE PELVIS SHOWING THE SHAPE AND DIAMETERS OF THE PELVIC INLET.

pubis projects vertically and makes a prominence of from $\frac{1}{4}$ to $\frac{3}{8}$ of an inch (0.63 to 1 cm.). Toward the sides the surface is smooth, and then come the internal obturator or sub-pubic fossæ. The posterior region consists of the surfaces of the sacrum and coccyx. This part is concave from above downward, the curve being deepest at the junction of the second and third sacral vertebræ. Down to this point the curve is very flat; which makes the axis of the cavity straight above this level. The lateral regions consist of two well-defined parts; the anterior being entirely bony and corresponding to the posterior part of the acetabula and to the ischial body and tuberosity; and its direction is from above downward, from without inward, and from behind forward. The posterior part consists for the most part of the internal face of the sacro-sciatic ligaments and foramina. The direction of this part is

the converse of the anterior, it being from above downward, from without inward, and from before backward.

Pelvic Cavity Measurements.—(See Pelvimetry, page 167.)

The depth of the pelvis at the symphysis is $1\frac{5}{8}$ inches (4 cm.). The depth of the lateral wall over the smooth surface of the ischial bones is $3\frac{1}{2}$ inches (9 cm.). The depth of the posterior wall, following the course of the sacrum and coccyx from promontory to tip of coccyx, is $4\frac{1}{2}$ to 5 inches (11.5 to 12.5 cm.).

The *obstetric landmarks of the cavity* are as follows: (1) The pubic joint in front; (2) the obturator foramen; (3) the spine of the ischium; (4) the great sacro-sciatic ligament and foramen; (5) the small sacro-sciatic ligament and foramen; (6) the sacrum and coccyx.

The Pelvic Outlet.—The pelvic outlet or inferior strait is the lower opening of the cavity of the true pelvis (Fig. 515). While there is at the pelvic inlet

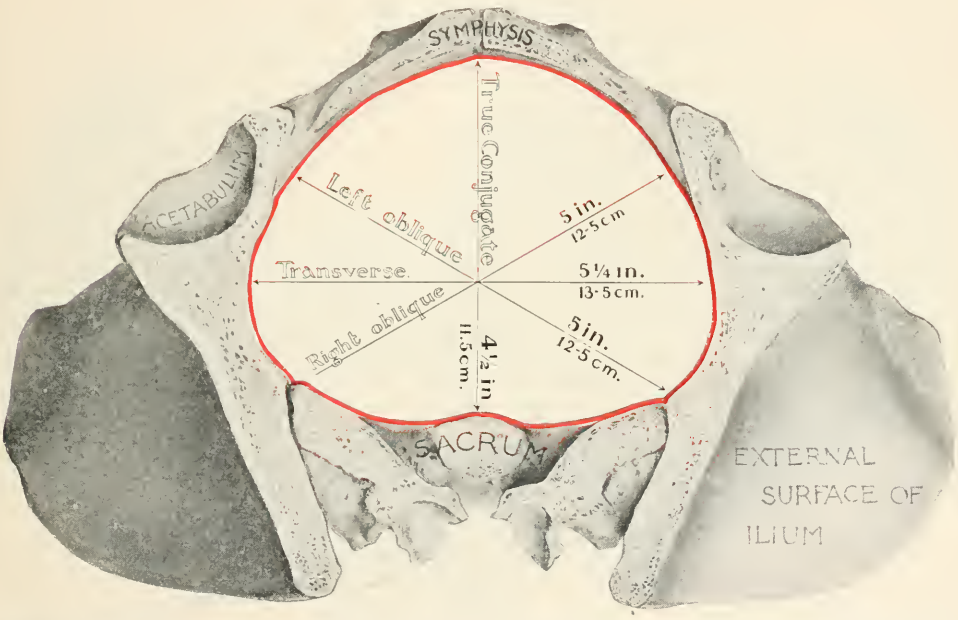

FIG. 514.—TRANSVERSE SECTION THROUGH THE TRUE PELVIS JUST BELOW THE PELVIC INLET AND PARALLEL TO IT.—(*Author's collection.*)

a continuous ring of bone, the circumference of the pelvic outlet is partly bony and partly ligamentous, and there are, besides, certain projections not found at the inlet; namely, the spines and tuberosities of the ischia separated by notches, and certain indentations also, the most important being the pubic arch. The anatomical outlet is the real outlet of the true pelvis and is bounded behind by the coccyx; in front by the sub-pubic ligament; on the sides by the ischio-pubic rami, the ischial tuberosities, and the greater and lesser sciatic ligaments. The obstetric outlet is just above this, and is the circumference of greatest bony resistance of the true pelvis as well as the smallest in size. It is bounded by the posterior surface of the symphysis pubis about $\frac{1}{4}$ inch (0.625 cm.) above the lower margin; the upper portions of the ischial tuberosities and the lower border of the sacrum.

Shape.—Its shape is that of a diamond or of two triangles having a common

base, and varies with the mobility of the coccyx, and in labor it becomes almost circular, thus being more changeable than the pelvic inlet. In the sitting posture the weight of the body rests entirely on the ischial tuberosities, since they are on a lower plane than the tip of the coccyx; and this explains why transverse pelvic contractions are so much more frequent at this strait than are the antero-posterior ones. Although the two lateral notches are so deeply marked in the bony pelvis, they are made very superficial by the sacro-sciatic ligaments. The anterior notch is known as the arch of the pubis. The columns of this arch are twisted outward,—this being more marked in the female,—and so assist in the passage of the head in labor. By the yielding of the sciatic ligaments the oblique diameters may be somewhat increased; this is not

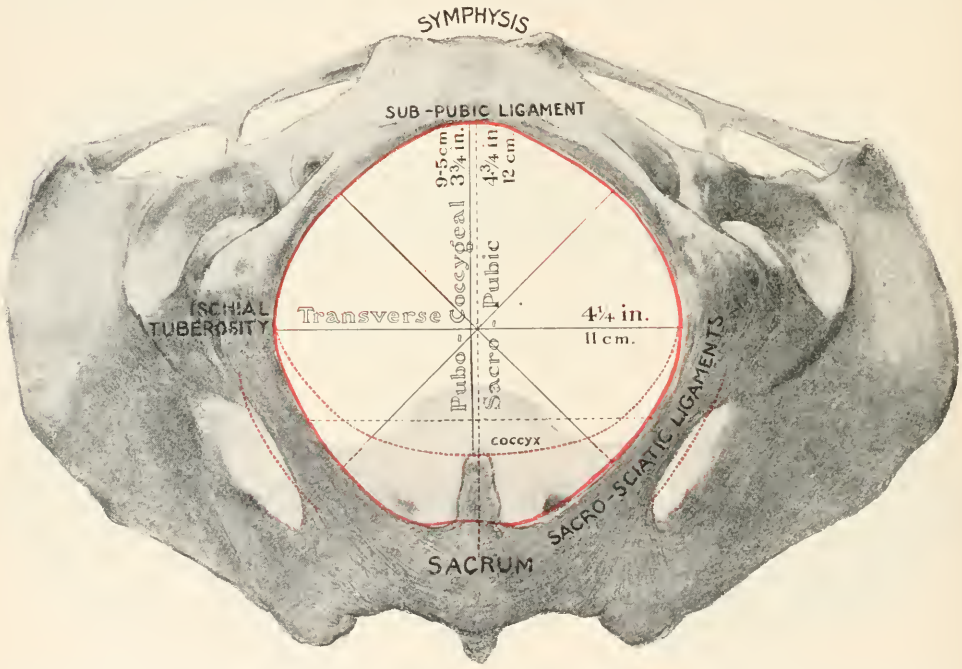

FIG. 515.—THE INFERIOR SURFACE OF THE PELVIS, SHOWING THE SHAPE AND DIAMETERS OF THE PELVIC OUTLET.

important. However, there is an important increase in the antero-posterior diameter, resulting from recession of the coccyx, so that although this diameter is the shortest one of the inlet, it becomes the longest of the outlet.

Pelvic Outlet Measurements.—(See Pelvimetry, page 168.) The *circumference* of the pelvic outlet is 18 inches (45 cm.).

Obstetric Landmarks of the Outlet.—Taking them from before backward, we have: (1) The pubic arch, and at its apex the sub-pubic ligament. (2) Passing backward, we have the descending ramus of the pubis and ascending ramus of the ischium which assist in bounding the obturator foramen and in forming the pubic arch. (3) At the junction of the two ischial rami is a thickened projection, the tuberosity of the ischium. (4) Upon the posterior border of the descending ischial ramus, and projecting forward, is a sharp spine,—the spine of the ischium,—which when well marked plays an important part

in the mechanism of labor. (5) The great and small sacro-sciatic ligaments. (6) The coccyx.

Pelvic Planes.—The planes of the pelvis are imaginary levels at different portions of the cavity; thus, we have a plane of the inlet, planes of the cavity, and a plane of the outlet. By a pelvic plane we mean simply a mathematical surface without depth or thickness. The short, slightly curved, cylindrical cavity of the true pelvis, bounded by the bony walls already described, varies in shape and size at various levels. For convenience in describing these variations and pelvic inclination and angles, we erect imaginary levels at different parts of the cavity of the true pelvis. If we accurately fit a piece of cardboard into the inlet of the pelvis, the level surface thus produced would

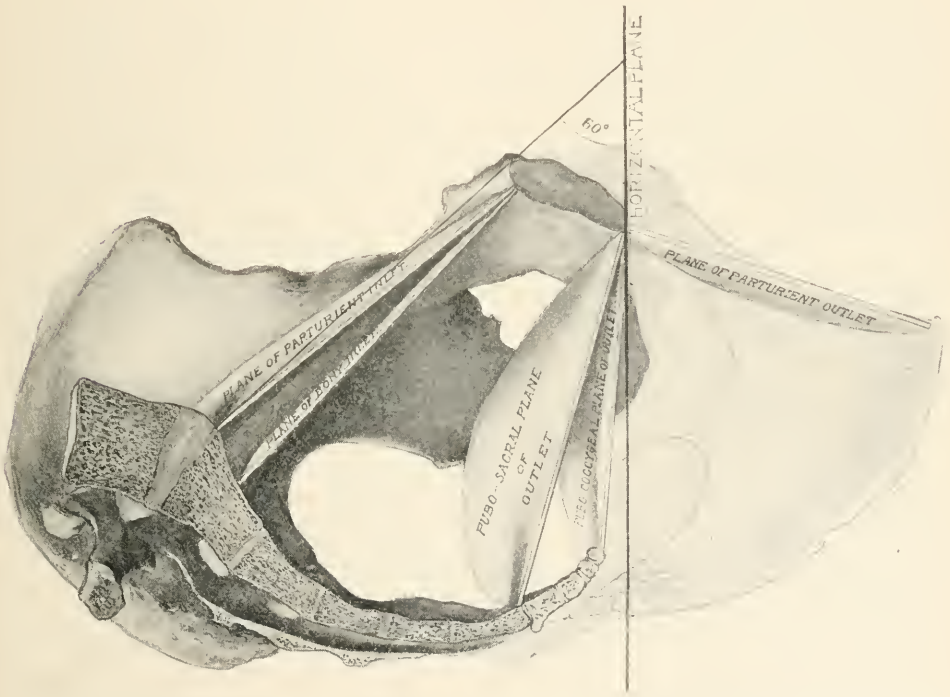

FIG. 516.—PLANES OF THE BONY PELVIS AND PARTURIENT TRACT. Plane of the parturient inlet; plane of the bony inlet; pubo-sacral plane of the outlet; pubo-coccygeal plane of the outlet; plane of the parturient outlet.

represent the plane of the pelvic inlet (Fig. 516). In like manner we have a plane of the outlet, and planes of the cavity. It is in studying these pelvic planes that we observe that the planes of the inlet and outlet are not parallel with each other, are not at right angles with the axis of the body, nor are they parallel with the horizon. (See Pelvic Angles.) Moreover, it is upon changes in the shape and size of these pelvic planes that the presence of pelvic deformity depends.

Plane of the Pelvic Inlet (Fig. 516).—As the obstetric conjugate is the available antero-posterior space at the inlet, so the *obstetric plane* of the inlet is the space available at the inlet for the passage of the fetal head and body. It does not coincide with the anatomical conjugate nor with the anatomical

inlet. The plane of the obstetric inlet would be represented by a piece of cardboard that so fitted the entrance of the pelvis that its margins corresponded to the base of the sacrum, the ilio-pectineal line, and the posterior surface of the symphysis along a transverse line $\frac{2}{3}$ inch (1 cm.) below its upper margin.

Planes of the Pelvic Cavity (Fig. 516).—Hodge constructed a series of planes parallel to the plane of the inlet. These planes are obsolete, and we now speak of the plane of greatest pelvic dimensions or middle plane.* It extends from the middle of the posterior surface of the symphysis pubis, over the central points of the internal surfaces of the acetabular cavities, to the upper margin

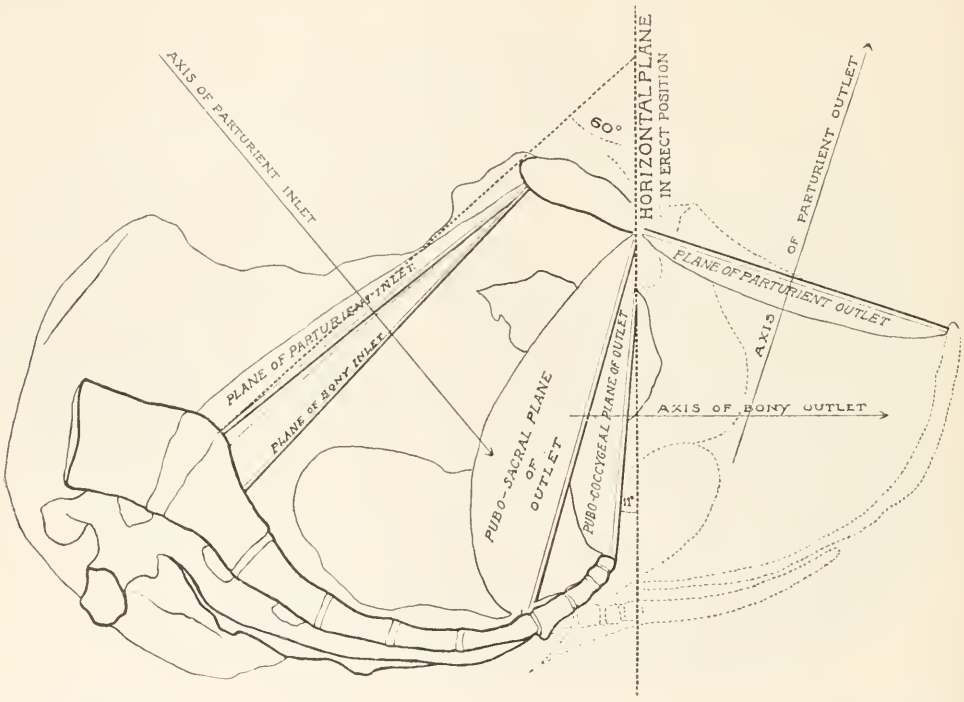

FIG. 517.—PLANES OF THE BONY PELVIS AND PARTURIENT TRACT, AND AXES OF THE PARTURIENT INLET AND OF THE BONY AND PARTURIENT OUTLETS.

of the third piece of the sacrum. This is the largest plane of the pelvis; the next in size is that of the inlet, and that of the outlet is the smallest.

Plane of the Pelvic Outlet (Fig. 516).—As at the inlet, so here we have an anatomical plane of the outlet and an obstetric plane. The latter is somewhat above the former and is the plane of greatest bony resistance at the outlet. It is also the smallest transverse plane of the entire pelvis, and we also term it the plane of least pelvic dimensions.†

* German, *Beckenweite*.

† *Beckenenge*. It touches the posterior surface of the symphysis pubis about $\frac{1}{4}$ of an inch above its lower margin, just above the ischial tuberosities, and the lower border of the sacrum. While this is the smallest transverse plane of the pelvis, it must be remembered that the yielding character of the sciatic ligaments allows of marked expansion in the posterior segment during the expulsion of the fetus.

Plane of the Parturient Outlet (Figs. 516 and 517).—At the moment that the presenting part is expelled, the plane of the parturient outlet, or, to be more exact, of the vulvo-vaginal ring, is nearly parallel with the long axis of the mother's body, and, with the woman in the dorsal posture, looks almost directly upward.

Pelvic Axes.—The axes of the pelvis are imaginary lines passing through the centers of the planes of the pelvis, and at right angles to them (Fig. 517). *The axis of the inlet* is represented by a line drawn perpendicular to the center of the plane of the pelvic inlet. This line, prolonged upward, strikes the anterior abdominal wall near the umbilicus; and projected downward, ends at the fourth piece of the sacrum (Fig. 517). *The axis of the cavity* is represented by a curved line joining the centers of a series of planes extending from the pelvic inlet to the outlet, and including these latter planes. It should be stated that the axis of the true pelvis is an axis of a curved and not a straight cylinder, and hence is a curved line, and practically is dependent upon the curves of the sacrum and coccyx, and thus of necessity differs according to the individual. *The axis of the parturient tract*, as will be shown later (Fig. 517), is a continuation of the axis of the cavity beyond the bony outlet, by the distention of the tissues which go to form the pelvic floor. (See page 408.) *The axis of the bony outlet* is a perpendicular line passing through the center of the plane of the outlet, and when there is no recession of the coccyx, this line, prolonged upward, strikes the promontory; when the coccyx is pushed backward, the axis of the outlet strikes the lower border of the first sacral vertebra. *The axis of the parturient outlet* is a perpendicular line passing through the center of the plane of the parturient outlet. This line is nearly at right angles with the long axis of the mother's body, and is nearly perpendicular. If extended backward and downward, it passes some distance below and in front of the end of the coccyx.

Pelvic Inclination and Angles.—In the upright posture of the body the plane of the pelvic inlet is inclined obliquely downward. The angle between the conjugate and horizon measures 55 to 60 degrees, while the same angle at the outlet is 11 degrees (Fig. 517). The inclination exhibits a good deal of variability. Not only are there differences in the same measurement in different individuals, but the angle is essentially altered by the position of the limbs. Thus, it is increased by extreme flexion of the legs and by extreme abduction and outward rotation of the thighs. The angle is smaller when the thighs are moderately abducted and in slight inward rotation. The size of the angle of inclination may be of diagnostic importance, since it calls our attention to certain anomalies of the pelvis. As a rule, a change in the direction of the plane of the inlet means a corresponding alteration in the axes of the uterus and fetus, so that the influence of the inclination upon labor is much less than was formerly supposed. On the other hand, the variation of the plane of the inlet and axis of the uterus in the different postures of the body is a matter of importance to the obstetrician. (1) If the woman lie flat on her back with extended limbs, the plane of the inlet sinks backward until it forms an angle of 25 degrees, open in front, with the horizon. (2) If she assume the knee-chest position, this plane forms with the horizon an angle of 15 or 20 degrees, open behind. (3) If the pelvis and spinal column are approximated, the size of the angle is increased. (4) If the woman lie upon her back across the bed in such manner that her thighs hang over the side of the latter, the pelvic inlet is expanded. This is the so-called Walcher position, to be considered from another point of view. (See Posture in Obstetrics, Part X.)

FIG. 518.—EARLY ANTENATAL PELVES. (Natural size.)—(*Author's collection.*)

In this connection it is only necessary to state that while the angle between the inlet plane and horizon is less than in the flat dorsal position, the angle between the conjugate and lumbar spine is notably increased. (5) If the woman, lying upon her back, flexes her legs at both the hip and knee, and at the same time approximates them moderately, forming the lithotomy position, the pelvis rotates a little upon its transverse axis so that the angle of the flat dorsal position is increased from 25 to 30 degrees or over. (See Part X.) If now the thighs and legs are flexed to the utmost so that the thighs are pressed tightly against the abdomen,—the exaggerated lithotomy position,—the pelvis continues to rotate upon its transverse axis until the angle reaches 60 degrees. There is a corresponding diminution in the angle between the spine and conjugate. (See Part X.) (7) If with the woman in the flat dorsal position the trunk is raised so that a reclining posture is assumed, the original angle of 25 degrees is reduced to 20 degrees. In the squatting or crouching posture the plane of the inlet is almost horizontal, and hence hardly any angle is present. Variations in the angle between the spine and pelvis are made possible by the slight mobility of the sacro-iliac joints and of the vertebræ with each other and with the sacrum. As has already been stated, the Walcher position causes an expansion of the pelvic inlet. The opposite effect of contraction is produced by the exaggerated lithotomy posture. For a statement of these phenomena and their practical application to the mechanism of delivery see Posture in Obstetrics, Part X. If a perpendicular falls at the middle of the pelvic inlet, it should pass through the coccyx below and the umbilicus above, provided that the angle between the vertebral column and conjugate is normal (125 degrees). If the perpendicular passes through the center of the outlet, it would pass through the promontory above. The symphysis makes an angle with the inlet of from 90 to 100 degrees. See also section on Cliseometry, page 178.

Comparison of Different Pelvic Diameters.—The most important facts to be remembered here are the diameters of inlet and outlet. As has been already noted, the shortest diameter of the inlet (antero-posterior, 4½ in.—11.25 cm.) corresponds when the coccyx has receded with the longest diameter of the outlet; and, conversely, with the longest diameter at the inlet (transverse, 5¼ in.—13.12 cm.) to the shortest at the outlet (4¼ in.—

11 cm.). In considering the mechanism of labor and the slow progress of the head as it gradually descends through the pelvic canal, a general rule will be observed concerning the relationship existing between the fetal head and these several diameters of the bony pelvis—namely, the long diameter of the fetal head corresponds to the longest diameter of the true pelvis.

Factors Influencing Size and Shape of the Pelvis.—1. *Individuality.*—The pelvis presents great individual variations. No two pelves are exactly alike. This is due to the varying influences of infancy and childhood, and shows itself in the thickness and shape of the bones, and the resulting influence upon the cavity of the true pelvis and the measurements in general. So great is the variation in the flaring of the ilia that we are accustomed to ignore the measurements between these bones in external pelvimetry.

2. *Sex.*—Just as in the other bones of the body, those of the pelvis are stronger, thicker, and rougher in the male than they are in the female (Fig. 507). The chief differences concern the cavity, and these are dependent in the female on the presence of the uterus. The male pelvis is far more angular and markedly cordate than the female, its structure is heavier, and it is less delicately curved. The female pelvis is broader and its cavity is rounder (Fig. 506). The dimensions of the internal iliac fossa are less in the female except the line drawn between the anterior superior iliac spine and the sacro-iliac joint; the iliac fossa is shallower in the female; the pelvis of the male is, as compared with that of the female, small, deep, steep, and funnel-shaped; the tuberosities of the ilium are, in the male, more developed and extend farther back; the pubic spines as well as the ischial tuberosities are more widely separated in the female. The sacrum presents two curves, concave from above downward and from side to side; this is more marked in the female than in the male, the bone being shorter and its direction downward and backward; in rachitis the lateral concavity becomes straight or even convex; the vertical concavity is not an arc of a circle but is bent; this bending point is known as the niche, and is found in the third sacral vertebra. The inlet is rounder in the female, and all the dimensions are greater, especially the transverse, which is not only longer but is placed farther forward than in the male pelvis. The outlet in the female is much larger on account of the recession of the ends of the sacrum and coccyx and the greater distance between the tuberosities. The acetabula are relatively farther apart and their surfaces look forward rather obliquely; this arrangement is not made to assist the function of the hip-joints in walking, and it accounts for the proximity of the knees of the female and for the peculiarity of gait. The sciatic notch is shallower and more open in the female. The pubic arch in the male is more acute, or about 70 to 80 degrees; in the female it is more rounded, 80 to 105 degrees; the distance between the symphysis and the tuberosities, the anterior pelvic wall, is longer than that of the female; in the female the ischio-pubic tubercle is turned more outward and the ischio-pubic ramus is concave in the middle. In the female there is marked pelvic inclination, while in the male it is slight. In the male the sacrum and coccyx are higher and more curved than in the female. The ischio-pubic foramen in the female is relatively larger and is more oblique externally and inferiorly; the common error that there is a difference in its shape in man and woman has been disproved. The ischia are more widely separated in the female; all the vertical diameters of the pelvis are greater in the male. Just as in other bones of the body, these characteristic differences in some pelves are marked, while in others they are slight, so as to make the distinction between male and female pelves difficult.

3. *Age.*—Infantile and juvenile pelvis. The pelvis is very small in the newly born child and is far less developed than the upper part of the body, and to this cause is due the greater prominence of the abdomen (Figs. 518 to 523). The larger part of the rectum and the bladder are almost wholly in the abdominal cavity, and it is not till puberty that their permanent position is assumed. Delivery is naturally made easier from the small size of the pelvis. At the time of birth there is a greater development of the false than of the true pelvis, the latter being straight and cylindrical in shape. It was not till recently that the infantile pelvis has been supposed to possess any special form. It is in great measure cartilaginous with points of ossification. The characteristics of the infantile pelvis, as compared with the adult, are: (1) The os innominatum is composed of ilium, ischium, and pubis; the ascending and descending rami are entirely cartilaginous; (2) the infant's pelvis is relatively more contracted; (3) the iliac bones stand more perpendicularly; (4) the sub-pubic angle is less; (5) the promontory of the sacrum is much higher and the sacrum is almost entirely straight; (6) the promontory of the sacrum forms a much more obtuse angle with the spinal

FIG. 519.—ANTENATAL PELVIS OF ABOUT THE SEVENTH MONTH. (Natural size.)—(*Author's collection.*)

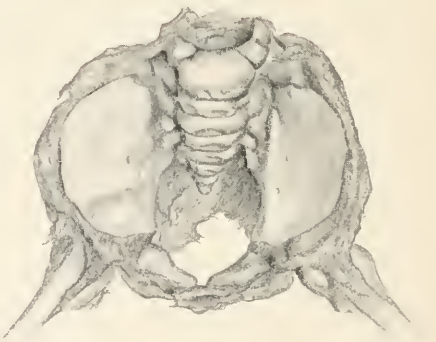

FIG. 520.—ANTENATAL PELVIS OF ABOUT THE EIGHTH MONTH. (Natural size.)—(*Author's collection.*)

column than is found in the adult pelvis (Figs. 518 to 521). The sacrum has twenty-one centers of ossification; each vertebral body, five; each vertebral arch, ten; and three on each side of the sacrum, making six for the alæ. This condition persists for some time, and it is not till late that the centers join. According to Litzmann, they unite from below upward; at three years the three lower bones are ossified; at seven years the sacrum is ossified; the three bones of the os innominatum join at puberty; at twenty, the pelvis assumes its normal shape. The sacrum in the newly born child is more or less wedge-shaped, but does not possess the antero-posterior curve of the adult sacrum and has little or no curve from side to side; the diminution is due to pressure causing the bodies of the vertebræ to press forward (Fig. 521). The alæ are poorly developed; the promontory of the sacrum is farther above the symphysis pubis; this distance is so great that Fehling, in considering the genesis of the pelvis, does not use the conjugata vera, but what he terms the conjugata vera inferior. The transverse width is less in the infant and the shape is more like a funnel, the pelvic walls being more markedly inclined.

Forces Leading to the Production of the Adult Pelvis.—These are important

because they sometimes lead to deformed pelves. There are two sets of factors to be considered. (1) *Congenital predisposition or tendency of the pelvis to assume a certain form.* This is evident when the differences between male and female pelves are noted, as both are subjected to the same forces. At birth the alæ of the first sacral vertebra are only one-half as long as the vertebral body itself. In the adult woman the alæ are 0.76 as long as the body. In the adult man they are 0.56 as long, making a difference of twenty per cent. The body of the second vertebra is three times as broad as in the child; the alæ are five times longer in woman and three times in man. (2) *Mechanical influences.* These are very important. They are the normal growth of the pelvic bones, the traction which ligaments and muscles exert upon the developing bones, the body-weight, the upward and inward pressure of the heads of the femora, and the cohesive force offered at the symphysis pubis. The excess or deficiency of any of these forces will modify the shape of the pelvis. If the pelvic bones do not develop normally before birth, a deformity will result which will be a form of the congenitally contracted pelvis; of this, the Naegele or Roberts pelvis is an example. The *body-weight* begins to exert its influence only after the child begins to sit up. Then the weight is exerted through the spinal column down through the sacrum. The first change consists in the tilting forward of the upper part of the sacrum and the pushing outward of the pelvic brim. The sacral promontory is lowered and approaches the symphysis pubis. Resistance is offered by the sacro-iliac ligaments, so that the degree of depression of the sacrum is limited. The pelvis then tends to rotate around a certain point backward, but the sacro-sciatic ligaments which fasten the tip of the sacrum to the ischii and ischiac spines resist this force, so that from the influence of all these forces there results the curve or bend at about the middle of the third sacral vertebra. This concavity distinguishes the adult pelvis from that of the child (Figs. 511 to 523). If there were nothing to oppose this rotation, the same

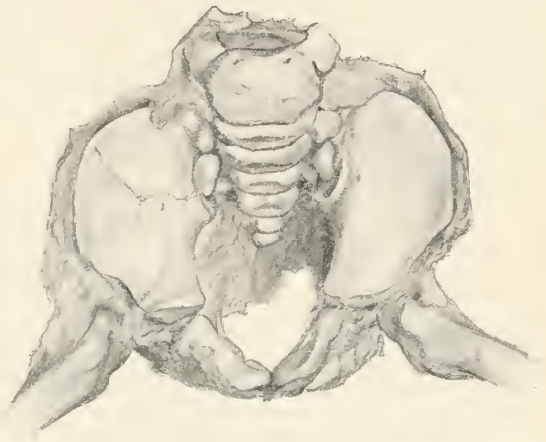

FIG. 521.—FETAL PELVIS AT THE FORTIETH WEEK. (Natural size.)—(*Author's collection.*)

FIG. 522.—BONY PELVIS OF A FEMALE CHILD OF TWO YEARS. (½ natural size.)—(*Author's collection.*)

shaped pelvis would be found in both child and adult. The lateral concavity is much greater in the infant. The adult pelvis is comparatively widened, since the antero-posterior diameter is lessened. As long as the child is on its back the body-weight exerts no influence. If it were not for the posterior ilio-sacral ligaments, the promontory of the sacrum would press against the posterior surface of the symphysis pubis. But the posterior part of the innominate bone extends beyond the spinal column. The ilio-sacral ligaments act as a hinge and tend to spread out the innominate bones, but this influence is resisted by the heads of the femora, which press upward and inward. The innominate bones act like a two-armed lever, with the sacrum as a fulcrum and the two forces—body-

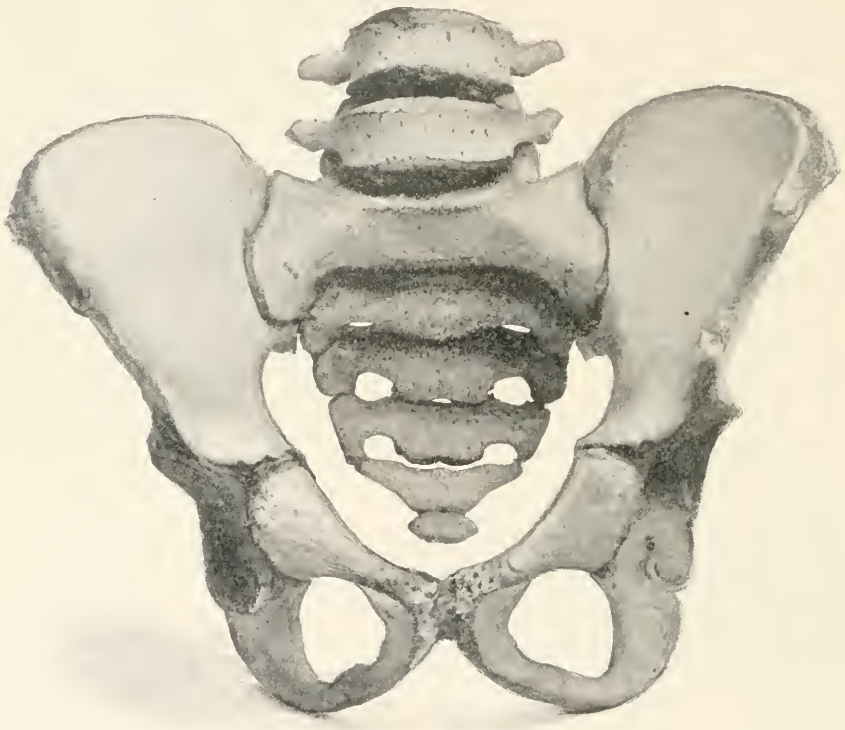

FIG. 523.—BONY PELVIS OF A FEMALE CHILD OF FIVE YEARS. ($\frac{3}{4}$ natural size.)—(*Author's collection.*)

weight and counter-pressure—exerted through the heads of the femora. So the iliac bone is bent just in front of the sacrum, thus producing the transverse widening of the superior strait. Another force is the cohesive force offered by the *symphysis pubis*, which counteracts the tendency of the ilia to flare out. Certain reported cases illustrate the effects of the various influences noted above. Gurlt found a hydrocephalic woman who had always lain in bed. She was thirty-one years old when she died. Her pelvis was a model of the infantile type, though larger in size. The force exerted through the femoral heads cannot act without the other forces, so that it never exists alone. Neither could cohesion offered by the symphysis pubis act alone. Clinically an example of body-weight acting alone has never been observed. Theoretically

it would indicate a split symphysis pubis and undeveloped legs. Freund, of Strasburg, experimented with a cadaver, which he suspended by the tips of the ilia. He cut apart the symphysis pubis; the ilia spread out while the symphysis gaped widely. Litzmann observed a case of split pelvis in which there was no union at the symphysis pubis, so only the two forces acted—body-weight and counter-pressure of the femora. The resulting pelvis was very wide posteriorly, while the counter-pressure of the femora caused the anterior portions of the innominate bones to become nearly parallel. The transverse width was marked. Holst saw a case, that of Eva Lank, who was born without lower extremities; thus the counter-pressure through the femora was lacking. The patient could sit up, consequently the forces—body-weight and cohesion of symphysis—were exerted There was a marked flattening of the pelvis and a widening of the transverse diameter. The absence of the counter-pressure of the femora and the long-continued pressure upon the ischial tuberosities caused the innominate bones to so rotate as to turn their crests inward and the ischial tuberosities outward, thus producing an excessive widening of the pelvic outlet. Somewhat similar changes are found in congenital dislocation of the hip, where the children have never walked. It is plain to see that any change from the normal in the action of the forces, or in the condition of the parts concerned, will result in a deformity of the pelvis which may vary from a slight to an extreme degree. All these facts are very important, and especially practical in relation to deformed pelves. The inferior races seem to be characterized by an inlet having a lessened transverse and increased conjugate diameter. Whenever a fair-sized average has been made, there has never yet been a people discovered in which the conjugate measured more than the transverse diameter. The consensus of opinion seems to point to the fact that favorable conditions of nutrition and activity lay the corner-stone for a well-formed pelvis.

Functions.—The functions of the pelvis are to form: (1) A ring by means of which the body-weight is transmitted to the lower extremities; (2) an axis which permits the movements of the lower extremities upon the trunk; (3) an attachment and lever for powerful muscles; (4) a cavity to contain the delicate pelvic organs; (5) a bony canal for the escape of the fetus from the abdominal cavity during parturition; (6) and to assist in the performance, through the pelvic floor, of the rectal and vesical functions.

2. THE SOFT TISSUES OF THE PELVIS. SOFT PARTS.

Familiarity with the bony pelvis alone is not sufficient for the obstetrician, but he must study the pelvis together with the soft tissues, muscles, ligaments, and cellular tissue which encroach upon the pelvic space and close in the openings of the latter, which is thereby converted into a basin-like body. The blood-vessels, the lymphatics, and the nerves also demand attention, and, finally, we must go back to our pregnant uterus, already studied under pregnancy, place it in position at the pelvic inlet, and carefully consider the pregnant and parturient tract or canal, extending, as it does, from the fundus of the uterus above the umbilicus, to the edge of the perineum, which latter in the second stage of labor may be distended five inches below the coccyx.

1. Muscles.—By the presence of the muscles of the pelvis, especially the ilio-psoas (Fig. 524), the transverse diameter of the inlet is made smaller than the oblique. This is one cause for the prevalence of the oblique position of the fetal head in cephalic presentations. The function of the musculature of the pelvic canal, ilio-psoas, obturator, levator, and other muscles, is mechanical

during parturition. They protect the bony pelvis and guide the presenting fetal part in a line which favors its expulsion; they also serve as cushions on which the fetus may rest and avoid injury from pressure. The muscles of the pelvic floor, especially the levator ani and coccygeus, during parturition are, to an extent,

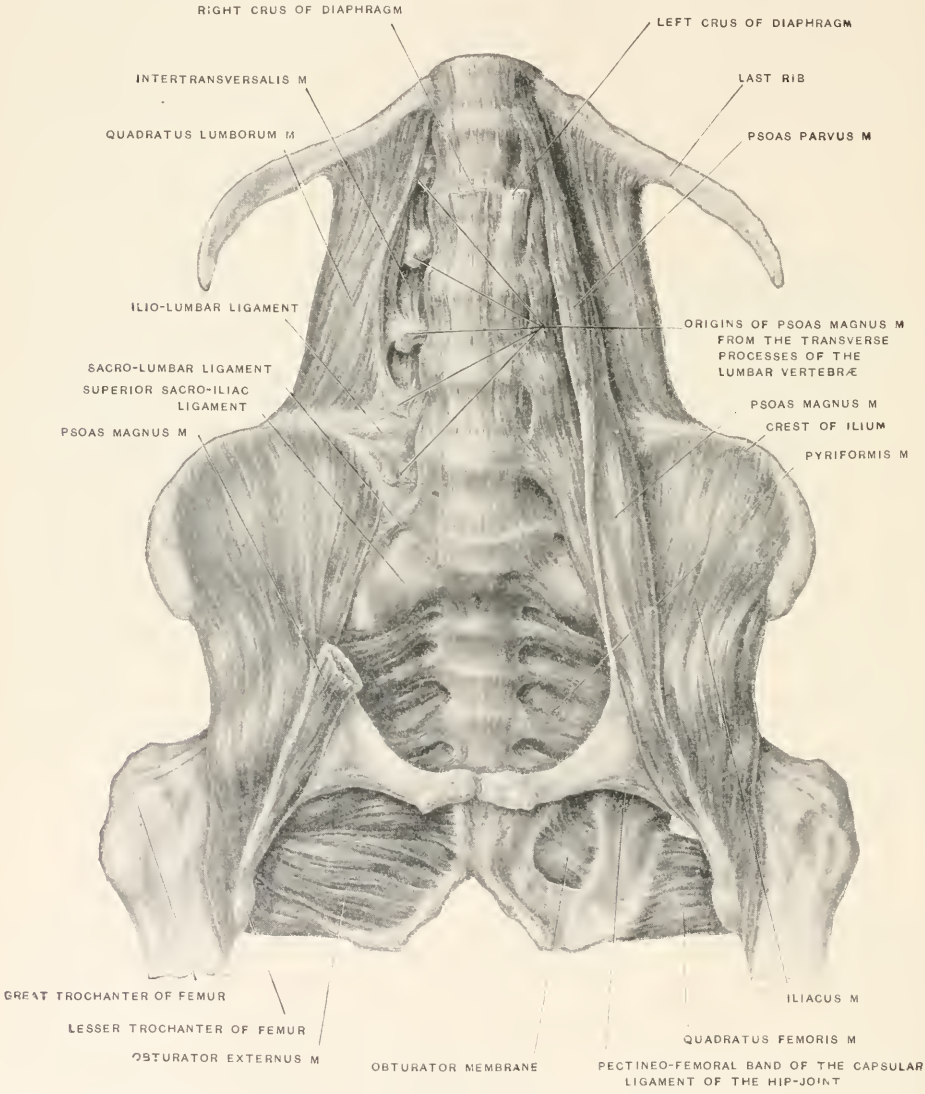

FIG. 524.—THE PELVIC INLET SEEN FROM ABOVE, SHOWING THE PSOAS AND ILIACUS MUSCLES.—(*Deaver.*)

passive. Their yielding is out and back, and they are often lacerated from their resistance to the presenting part. However, the direction of the resistance turns the head out and up under the symphysis. The functions of these latter muscles are to give support to the viscera of the pelvis, complete the lower end of the parturient canal, and to direct the presenting part to the orifice of the vulva.

Psoas Magnus (Fig. 524).—The psoas magnus is long and fusiform and is situated on the side of the lumbar region of the spine and the pelvic brim. It takes its origin from the bodies, transverse processes, and intervertebral substances of the last dorsal and all the lumbar vertebræ, and is inserted into the lesser trochanter of the femur by a common tendon with the iliacus. Its action is to flex and rotate the femur outward, also to flex the trunk and pelvis on the thigh. Obstetrically it acts as a "bumper" or protection between the fetus and the margin of the pelvic inlet; it diminishes the transverse diameter of the inlet, so that in the recent state the oblique diameters become the longest, and this partly explains the oblique position of the head in cephalic presentations.

Psoas Parvus (Fig. 524).—The psoas parvus is long and slender and is situated in front of the psoas magnus. It takes its origin from the bodies of the last dorsal and first lumbar vertebræ and the intervertebral substance, and

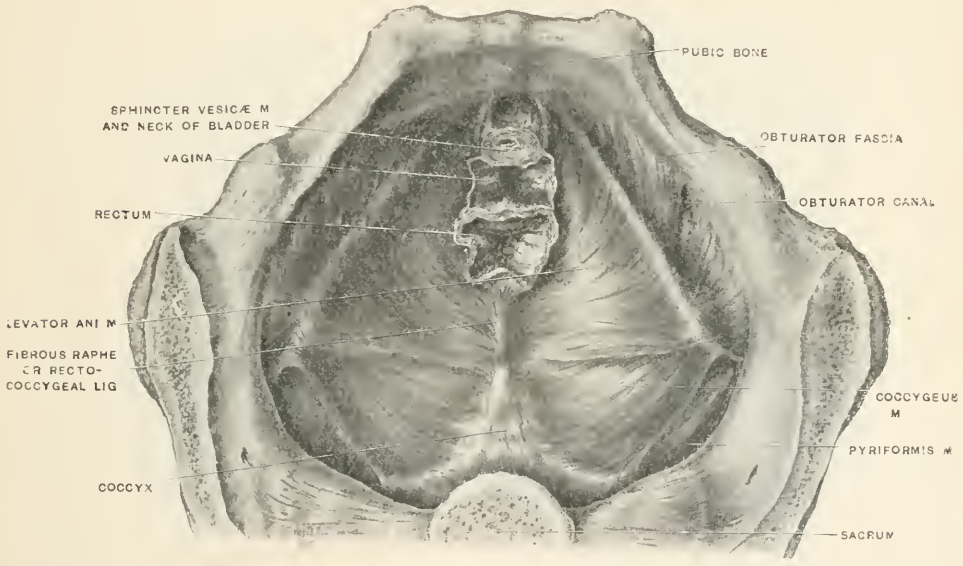

FIG. 525.—MUSCLES OF THE FEMALE PELVIC FLOOR—SUPERIOR VIEW.—(*Deaver.*)

is inserted into the ilio-pectineal eminence and the iliac fascia. Its action is to make tense the iliac fascia.

Iliacus (Fig. 524).—The iliacus is a flat muscle filling up the entire internal iliac fossa. It takes its origin from the iliac fossa, the inner surface of the iliac crest, ilio-lumbar ligament, base of the sacrum, anterior spinous processes of the ilium as well as the notch included between them, and from the capsule of the hip-joint. It is inserted into the external surface of the tendon of the psoas magnus. Its action is the same as that of the psoas magnus. The psoas and iliacus flex the thigh upon the pelvis while they rotate the femur outward: these functions are performed when they act from above. From below, with the femur fixed, the lumbar part of the spine and the pelvis are bent forward by the action of the muscles of both sides. By them also the erect position is maintained, since they support the spine and pelvis upon the femur, and help to raise the trunk when the body is recumbent.

Levator Ani (Fig. 525).—This muscle takes its origin from the body and ramus of the pubis posteriorly, the pelvic fascia, and the spine of the ischium, and is inserted into the tendinous center of the perineum, the sides of the rectum and vagina, the apex of the coccyx, and a fibrous raphé extending from the coccyx to the anus. There has been much contradictory discussion concerning the complicated form and functions of the levator ani muscle. The shape of the muscle is that of a horseshoe. It acts like a sling which is anteriorly attached to the pubes, and, passing backward in a horizontal plane, encircles the rectum and vagina (Dickinson) Luschka describes it as the diaphragm of the pelvis, but states that in many non-pregnant women it is almost membranous; we must remember, however, that there is always a hypertrophied condition of the muscle present during pregnancy. Its arrangement consists of flat bundles

Fig. 526.—The Parturient Pelvic Inlet Seen from above, showing the Narrowing of the Transverse Diameter Caused by the Psoas Muscles.

of muscle-fibers loosely connected, between which here and there are openings filled up with connective tissue and fat. The good use to which such a structure lends itself in the great distention of delivery can easily be seen. The depth of the levator in woman is less than that in man, corresponding with her shallower pelvis; while, as has already been shown, the horizontal measurements are greater. According to Henle, the longitudinal muscle-fibers of the lateral vaginal walls are intertwined with the fibers of the levator ani—an arrangement analogous to that about the rectum. The division of the levator which reaches to the front of the rectum is a very narrow band. In shape it resembles a bow, with its most inferior extremity about one-half inch above the anus. This band arises at the outer side of the pubic origin, crossing over the larger bundle in its course. This part of the muscle in women

is very small and is "collected together in the recto-vaginal septum." This fact can be proved, as a rule, by palpation. The connection between the levator and the walls of the rectum is very intimate, although none of the muscle-fibers end in the walls. There is the same intimate intermingling with the longitudinal muscle-fibers as was noted about the vagina. The *functions* of this muscle are numerous and important: (1) During the internal rotation of the second stage of labor the levator, together with the coccygeus, internal obturator, and transversus perinei, are the chief causes in determining the anterior rotation of the lowest portion of the presenting part. (2) The most characteristic action of the levator is to draw forward toward the symphysis the anus and perineal body, thus directing the head or presenting part out under the symphysis, and relieving the strain on the perineum. (3) In the female the pubo-coccygeal part of the levator ani serves the purpose of a sphincter muscle of the vagina, and perhaps of the urethra after the collapse of the vagina. (4) It antagonizes the diaphragm in its action on the pelvic contents, as it rises and falls with it in deep respiration. When the abdominal muscles are acting energetically, this muscle yields, enabling the pelvis to endure a greater strain than if it were more resistant. When the tension is removed, the muscle restores the perineum to its original condition. (5) It assists in the formation of the pelvic floor and supports the lower end of the rectum, vagina, and bladder. According to Studdiford,* the levator ani does not form a sling, but is more like a narrow V with sides slightly convex toward the median line A band of involuntary muscular fibers seated between the rectum and vagina serves to connect the two portions of the levator. This is the muscular band which may be felt behind the posterior vaginal wall. By its action the two segments of the levator ani are approximated, so that the vagina is forced upward behind the pubis while the rectum and coccyx, and probably the external sphincters, are drawn forward. Studdiford attaches great importance to this band of smooth muscle, and believes that by its automatic action the levator is enabled to furnish continuous support to the pelvic viscera.

Obturator Internus (Fig. 525).—It takes its origin from the inner surface of the obturator membrane and the posterior osseous edge of the obturator foramen, as far as the ilio-pectineal line above and the sacro-sciatic notch behind; its fibers converge and form a tendon which passes through the small sacro-sciatic foramen, and then is directed downward and backward to be inserted into the digital cavity of the great trochanter. Its action is to rotate the thigh outward; to assist in increasing the resistance of the posterior segment of the pelvic floor; to act as a bumper and protection to the fetus. Owing to its thinness, this muscle does not materially affect the dimensions of the pelvic cavity.

Pyriformis (Fig. 525).—The pyriformis arises by three digitations from the front of the second, third, and fourth sacral segments, from the border of the great sacro-sciatic foramen and the great sacro-sciatic ligament, and is inserted into the upper border of the great trochanter after having passed through the great sacro-sciatic foramen. Its action is to rotate the thigh externally; it helps to form the posterior and outer wall of the pelvic cavity; in fact, its action is the same as that of the obturator internus.

Coccygeus (Fig. 525).—This is a small, triangular muscle, by many included in the description of the levator ani. It is situated in front of the small sciatic ligament, between the levator ani and the pyriformis. This muscle takes its origin from the spine of the ischium and radiates its fibers in the form of a

* "New York Medical Journal," April 12, 1902.

fan and is inserted from the tip of the coccyx to the lateral surface of the two lower sacral vertebræ, filling up the open space behind the levator. Its action is to support the coccyx and to close the pelvic outlet behind. The pelvic surface helps to support the rectum, while externally it is closely connected with the lesser sacro-sciatic ligament. This muscle assists in restoring the coccyx to its original position after the strain of parturition or defecation is passed. In caudate animals it is strongly developed and causes lateral movements of the tail.

Bulbo-cavernosus (Fig. 525).—This muscle, which is sometimes misnamed the sphincter vaginæ or constrictor cunni, is analogous to the lateral half of the male accelerator urinæ muscle. Analogous to the rôle of the coccygeus, which completes the muscular diaphragm back of the levator, is that of the bulbo-cavernosus, which aids in closing the space between the ends of the horseshoe, although it is a thin, weak muscle. Each bundle takes its origin from the fascia of the perineum about half-way between the anal sphincter and the ischia, only a small band being connected with the sphincter (Luschka). Anteriorly the ends as they converge divide into three bands. One part goes to the inferior surface of the corpus cavernosum of the clitoris, another passes to the posterior surface of the bulb, and the third mingles with the mucous membrane between the clitoris and the orifice of the urethra (Henle). The action of this muscle is chiefly seen in its function of compressing the veins of the clitoris, and thus increasing the turgidity of the erectile tissue and so maintaining as well as creating erection of the clitoris. It is not a sphincter, although by means of its pressure inward on the turgid bulbs the vestibule of the vagina may be made smaller. Unless hypertrophied it cannot be discovered by palpation.

Transversus Perinei, or Ischio-bulbosus (Fig. 525).—This muscle arises from the ascending ischial ramus and is inserted into the base of the perineal body, the fibers of the two muscles intermingling at this point. Its action is to make the central tendon of the perineum tense, so that the other muscles attached in that vicinity may have a fixed point from which to act; it also antagonizes the action of the levator ani. In deep perineal laceration the two muscles tend to produce gaping of the wound, and interfere with union.

External Sphincter Ani.—From each side of the ano-coccygeal ligament, just beneath the superficial fascia, thin sheets of striated muscle-fibers arise, and passing forward blend with the other muscle-fibers ending in the perineal body, thus surrounding the anus elliptically. Its fibers are interwoven with those of the bulbo-cavernosus muscle. Its action is to contract the skin about the anus; to assist the levator ani in supporting the opening during the strain of defecation; and to close the anus.

2. Ligaments (Fig. 515).—The sacro-sciatic ligaments number four: two posterior and two anterior. The great sacro-sciatic ligament arises from the posterior inferior iliac spine and the posterior aspects and borders of the sacrum and coccyx, and is inserted on the internal border of the tuberosity and the ascending ischial ramus. The small sacro-sciatic ligament arises from the borders of the sacrum and coccyx, and is inserted into the ischial spine. The sacro-sciatic ligaments close the wall of the pelvis and offer protection to and direct the presenting part. The obturator membrane closes the foramen and acts as a cushion for protection of the presenting part. Besides the four sacro-sciatic ligaments there are the anterior, posterior, and lateral sacro-coccygeal ligaments, which connect the sacrum and the coccyx; the anterior, posterior, and superior pubic ligaments, connecting the two pubic bones.

These ligaments help to modify the shape of the pelvis and the direction of its axis, as well as to act as buffers for the presenting part.

3. The Pelvic Cellular Tissue.—It is only by the additional support afforded by layers of fascia or by a mixture of fibrous tissue that even the strongest muscle can resist strain that is prolonged. The pelvic cavity may be considered to be divided into two spaces—peritoneal and subperitoneal—by an imaginary plane which passes from the central point of the inner surface of the pubis to that point where the third and fourth sacral bones unite. With the exception of a part of Douglas's pouch the whole pelvic peritoneum should lie above this plane. It is beneath the plane in the intervals between the pelvic viscera where are the blood-vessels, lymphatics, and nerves, as well as fibrous and muscular tissue, and fibro-elastic elements, all of which comprise the cellular tissue of the pelvis. The proportions of these different elements vary according to the function to be performed. The function depends to a certain extent upon the situation of the tissue. When investing blood-vessels, it assists in the erectile functions of the venous system of the pelvis. When used as an attachment for organs, it becomes more ligamentous in character and helps to preserve the mutual relations of the organs which it helps to connect as well as their normal position. Some parts of it act as lines of traction upon different parts of the uterus. Parts of it keep in contact the vaginal walls, since that organ is not only drawn backward but also toward the side of the pelvis. This tissue also forms part of the uterine system. During pregnancy this tissue is greatly hypertrophied in order to fill the space that is left vacant when the uterus with its broad ligaments ascends. After delivery the excess of tissue is gradually absorbed, and the uterus and its ligaments by degrees return to their normal position. This tissue surrounds the cervix, and from this point reaches out between the layers of the broad ligaments to the wall of the pelvis.* The recto-vaginal process extends between these two organs down to the pelvic floor, and permits of the changing degrees of distensibility of these tubes. The vagino-vesical process is found between the superior part of the anterior wall of the vagina and the posterior vesical surface. There is no such deposit of connective tissue between these organs in the lower two-thirds of the vagina. Since the amount of tissue in this process is so small the pelvic peritoneum and the upper part of the anterior wall of the vagina come very close together when the bladder is empty—a point of value for the surgeon. The rectum and the sacrum are separated by a little connective tissue.

4. Blood-vessels and Lymphatics.—The *blood-vessels* of the pelvic floor consist of the branches directly or indirectly derived from the anterior division of the internal iliac, together with the veins which accompany them; besides these there are numerous plexuses which are in close proximity to the vesico-vaginal walls. The branches of the inferior pudic, the smaller of the terminal branches of the anterior trunk of the internal iliac, are: inferior hemorrhoidal, superficial perineal, transverse perineal, artery of the bulb, artery of the corpus cavernosum, and dorsal artery of the clitoris. The sciatic with its branches supplies the muscles on the back of the pelvis. Besides these the inferior vesical and vaginal arteries with small branches from the external pudic form a part of the pelvic blood-supply. The inferior hemorrhoidal and the superficial perineal arteries supply particularly the musculature

* Much work has been done of late years on the arrangement of this pelvic cellular tissue, by various methods: (1) By frozen sections and pelves hardened in spirit; (2) by injections beneath the peritoneum in various places and later tracing the ramifications; (3) by water injections; (4) by plaster-of-Paris injections.

of the pelvic floor. The superficial perineal artery passes through the superficial fascia to the superficial perineal space and supplies the neighboring structures, giving off the transverse perineal branch. The continuation of the internal pudic artery lies deeper, being between the two layers of the triangular ligament. Here the arteries of the vestibular bulbs and of the crura of the clitoris branch off. The internal pudic artery ends, having penetrated the anterior layer of the triangular ligament, as the dorsal artery of the clitoris, from which small branches reach the corpus cavernosum, the glans, and the prepuce. The ovarian arteries from the abdominal aorta pass to either side of the pelvis, and, running between the laminæ of the broad ligament, supply the ovaries and tubes, one branch passing to the fundus, another traversing the uterus and there anastomosing with a branch of the uterine artery. The latter artery passes down from the anterior trunk of the internal iliac to the uterine neck. Ascending the sides of the uterus one branch meets the ovarian, and one, the circular artery of the cervix. Incision of this artery or rupture causes marked hemorrhage. The most important veins are the tributaries of the pudic vein and those having an independent course forming a part of the vesico-vaginal and hemorrhoidal plexuses. This venous supply is abundant. The *lymphatics* owe their chief importance to their relation to septic absorption. The uterine lymph-spaces lie between bundles of connective tissue and are covered with endothelial cells. These finally lead to the thoracic duct. The glands of most importance are the sacral, lumbar, hypogastric, obturator, inguinal, and uterine.

5. Nerves (Fig. 155).—These are derived principally from the sympathetic system. From the uterine plexus are given off two hypogastric plexuses from which twigs pass to the uterus and ovaries. To the perineum are distributed branches of the internal pudic nerve and the inferior pudendal branch of the small sciatic. The pudic, inferior hemorrhoidal, superficial perineal, deep perineal, muscular filaments of the pudic, and dorsal nerve of the clitoris are described as the nerves of the female perineum.

3. THE PARTURIENT CANAL.

Definition.—This term is applied to the cavity of the uterus, cervix, vagina, and vulva, regarded as a single structure. Many obstetricians, however, restrict the term to the parts which lie below the internal os, and define the birth canal as the dilated passage or route by which the fetus must reach the external world through the action of the expulsive forces exerted in the abdominal region. The present conception of the birth canal as embracing the entire genital tract is regarded as the most expedient. The term parturient canal, however, does not apply to the genital passages in a state of quiescence. It is present then, of course, in a potential sense only. The actual canal exists only during labor, when the onward progress of the fetus, together with the active dilatation and resistance offered to its passage, transform the distensible structures into an anatomo-physiological entity which has its own individuality and which demands a careful description. A knowledge of the bony pelvis, the soft parts, and the changes which the uterus and other genitals undergo during pregnancy is requisite before proceeding to the study of the parturient canal.

Formation.—At the end of pregnancy the uterine cavity is distended by the mature ovum which is closely united to the external membranes, decidua, and uterine wall (Fig. 137). The internal os is tightly closed and the cervical

canal as well (Fig. 138). In the primigravida the external os is likewise closed and but slightly patulous in the multigravida. (See page 138.) A similar condition of stenosis is present in the vagina and vulva. The potential cavity now consists of two sections, the upper of which is represented by the uterine cavity, while the lower comprises all the parts below the latter. The upper section, already distended to the utmost, will dilate no more, but tends, on the contrary, to contract upon and expel its contents, thereafter resuming

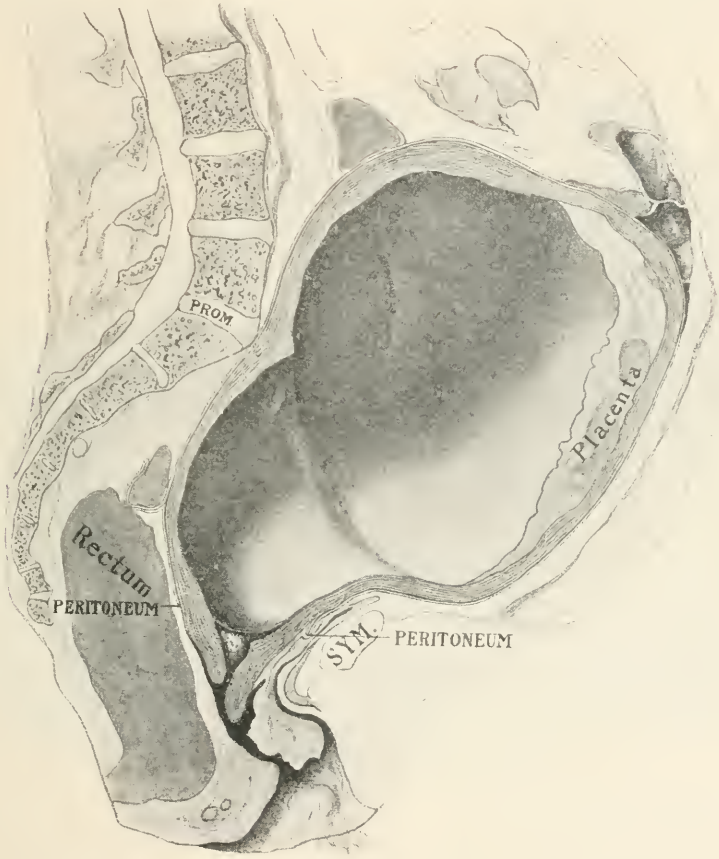

FIG. 527.—FROZEN SECTION AFTER SUDDEN DEATH FROM CEREBRAL ABSCESS DURING THE FIRST STAGE OF LABOR. Age of patient thirty-seven years; 7-para; fundus uteri 3 inches above the umbilicus; internal os dilated to admit two fingers. The section shows the interior of the left half of the uterine cavity with placenta and membranes *in situ*. Note that the internal os has not been drawn up into the walls of the uterus; the beginning formation of the contraction ring just above the plane of the pelvic inlet, and that the rectum is impacted with feces.—(*William C. Lusk's case.*)

its original and natural state of closure. The lower section, on the other hand, heretofore in a state of natural occlusion, must now be subjected to the utmost degree of distention. The transformation of the potential into the actual cavity, then, affects only those parts which have no active function of contraction. The precise line of demarcation between the two segments of the uterus—*i. e.*, the functionally active and the functionally passive—is a matter of dispute. It was formerly assumed that the internal os marked the boundary

between the segments, for in the state of quiescence this structure appears to indicate that the first act of labor must be to overcome the resistance at this point.

Contraction Ring.—According to modern teaching, the very first step in the establishment of the parturient canal is the formation of the so-called contraction ring, in the uterine wall at a point somewhat higher up than the anatomical internal os, which latter, it is claimed, is of no assistance whatever in the parturient canal (Figs. 527, 530). This contraction ring, which often goes by the name of Bandl's ring, is seated at a point

Fig. 528.—Frozen Section of the Uterus and Fetus from a Primipara, Aged Twenty-four, who Died Suddenly from an Unknown Cause Two Hours after Admission to the Emergency Hospital. Labor had continued twenty-four hours, and at time of death secondary inertia was present. The cadaver was frozen within twenty-four hours, and the section made forty-eight hours from death. The caput succedaneum is distending the parturient outlet, and the head lies upon the pelvic floor in the left occipito-anterior position before anterior rotation of the occiput. (Compare Figs. 529 and 530.)—(*Dr. W. E. Studdiford's case at the Emergency Hospital.*)

in the uterus opposite a large coronary vein, and at which the serous coat of the organ adheres intimately to the subjacent muscle (Figs. 529, 530, and 531). It constitutes a wall-like ridge along the uterine cavity and divides the latter into two segments, known as the upper and lower uterine segments, which are peculiar to the parturient canal, having no existence save during the act of labor (Fig. 530). The transitory existence of this ring gives it a problematic character. We do not know whether it is always the same in different uteri or even in the same uterus at different periods. That it undoubtedly exists has been shown by frozen sections of women dying in labor (Figs. 531 and 532)

and by digital exploration during labor, while its existence is often implied by various phenomena during parturition, such as special types of dystocia and peculiar forms of rupture of the uterus. It is by no means certain that those uterine fibers which lie between Bandl's ring and the site of the internal os do not contract to some extent. Another dubious point refers to the possibility of independent contraction of the ring, most obstetricians holding that this contraction is necessarily a part of the general action of the uterine muscle. The consensus of opinion is that the ring is non-existent save during a labor pain. Veit,* who has recently written at length upon the contraction ring, claims that with the beginning of dilatation that part of the uterus which is

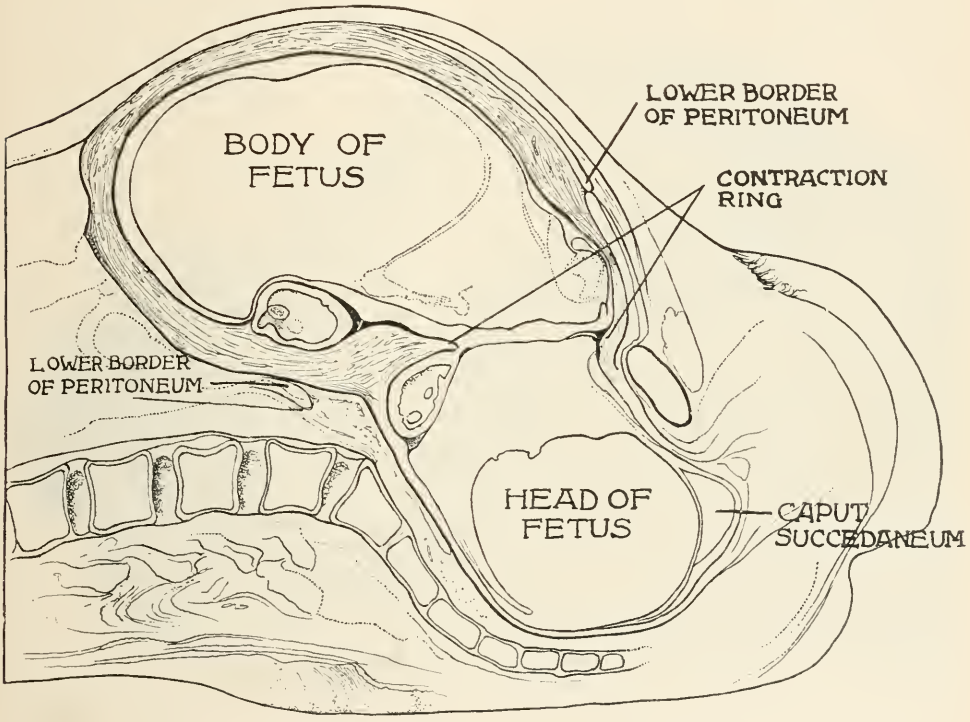

Fig. 529.—Outline of Fig. 528 with Explanatory Titles.

to form the future inferior uterine segment is distinctly thinner than the upper or functionally active segment.

Cervical Dilatation.—The labor pains acting upon the amniotic fluid which invests the fetus make uniform pressure within the uterine cavity. The potential cavity of the cervix is naturally the locality which must give way by a process of dilatation, and the amniotic sac with its fluid is forced into this cavity in a wedge shape. With the inception of the pains the membranes begin to separate from the contractile portion of the uterus, remaining adherent, however, below the site of the actual or hypothetical contraction ring. This separation varies in kind. Usually it occurs between the layers of the decidua, although in some cases the detachment occurs between the chorion and amnion. Next in sequence to the formation of the contraction

* "Monatschrift f. Geburts. u. Gynäkol.," Feb., 1900.

ring and dilatation of the cervix there occur certain changes throughout the uterine walls.

Uterine Walls.—As the cavity of the uterus begins to discharge its contents the muscular bundles which constitute the uterine wall undergo a process of readjustment. Lamellæ of muscle which were formerly superimposed in strata now come to lie side by side, with resulting thinning of the uterine wall. (Compare Figs. 530 and 531.) At the same time there ensue changes in the position of the uterus. The latter begins to move backward and at the same time to ascend. During the formation of the birth canal the fundus gradually ascends until it reaches the costal arches, and synchronously with this ascent there is also a slight lateral deviation, usually to the side which

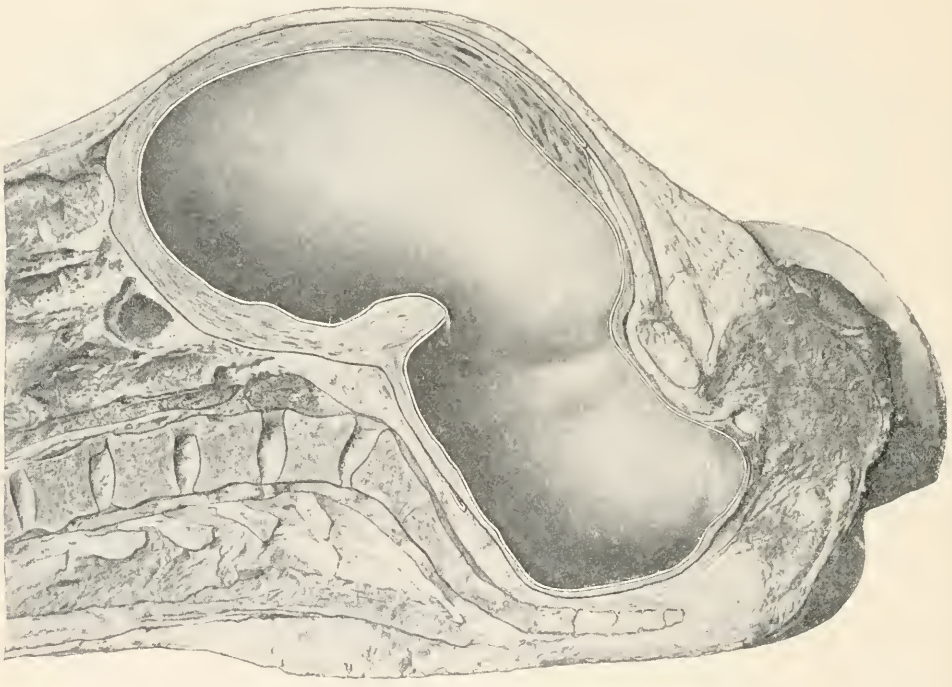

Fig. 530.—Frozen Section seen in Fig. 528 with Fetus Removed. Note the contraction ring; the unruptured membranes; the shape of the parturient tract, including uterus and vagina, and the thinness of the lower and the thickness of the upper uterine segments.—(*Dr. W. E. Studdiford's case at the Emergency Hospital.*)

is opposite to the fetal back. As the uterus rises the contraction ring also ascends, and when the birth canal is fully formed the ring should be nearly midway between the symphysis and navel (Figs. 527 and 529). This traction which affects the upper segment and ring must affect the lower segment as well; but as the cervix is held fast below, the lower segment must undergo a process of stretching. In the primipara the dilatation of the cervix is a much more laborious process than in the multipara, for in the latter much less resistance is encountered owing to the semi-patulous condition of the external os and cervical canal. In other words, the multiparous uterus has to oppose chiefly the resistance of the internal os. The lax walls of the *vagina*, abundantly moistened by the natural secretions, offer but little resistance to the

fetal head, by which they are readily separated. In primiparæ, however, the degree of resistance is considerable. The maximum of opposition is found at the *ostium vaginæ*, where the distensibility is much less marked, and where, moreover, additional resistance proceeds from the active contractions of the levator ani muscle. This resistance is gradually overcome by the advancing head, and is always much greater in the primipara, causing prolongation of the period of expulsion.

The completed canal or tract through which the process of expulsion takes place is irregular, with a curved axis (Fig. 516); the successive cross-sections vary in shape in a definite manner, and the walls of the canal vary in rigidity at the various segments. This canal, when completed under the combined influence of the active uterine contractions and the passive dilatation of the parts below the contraction ring, may be divided into three portions: viz., (1) suprapelvic, (2) pelvic, and (3) infrapelvic.

Suprapelvic Portion.—The suprapelvic portion consists of the uterus, and although it is a part of the parturient canal mechanically considered, it is more especially the force which urges the fetus on than a part of the passageway through which it travels.

Pelvic Portion.—The pelvic portion contains the cervico-vaginal portion of the birth tract. During the elongation of the uterus and dilatation of the os the cervix lies within the pelvic excavation. The custom of describing the bony pelvis as a portion of the birth tract does not appear to me to be advisable (Fig. 516).

Infrapelvic Portion.—This consists of the distended and thinned sacral segment of the pelvic floor (Fig. 516). When the utero-vaginal portion of the birth tract has been formed by the act of labor, another step is required for the completion of this structure, viz., elongation of the pelvic floor. When the head of the child is upon the pelvic floor, the latter must necessarily go through some form of violent alteration in shape before the passage of the fetus. The capacity of the floor for distention is limited. But these changes in the pelvic floor are not wholly effected in the single act of expulsion. A study of this structure in frozen sections and otherwise shows that there are natural differences between its relation in the non-pregnant and that in the pregnant at term. While in the former the pelvic floor projects but slightly below a line which passes from the tip of the coccyx to the lower border of the symphysis, in the woman at term the perineum is already relaxed as well as thickened by œdema, so that it bulges considerably beneath the natural level. The ascent of the uterus, already described in connection with the formation of the utero-vaginal portion of the birth tract, tends to draw upward the parts anterior to the vagina; so that the fetal head does not force them below the symphysis (Fig. 573). The distensible portion of the pelvic floor is therefore the portion posterior to the vagina known as the sacral segment of the pelvic floor. This segment appears at first sight to be thrust forward, and at the same time elongated by the advancing head. But a study of lead-tape tracings upon the pelvic floor during labor shows that the soft parts are really forced backward, and at the same time excessively thinned. The anus is moved backward. The pelvic floor projects but one inch in the non-pregnant. At term its projection is $2\frac{3}{4}$ inches (7 cm.), and during labor an additional inch is added. The normal perineum is $1\frac{1}{4}$ inches (3.17 cm.) long, while during complete dilatation it measures $2\frac{1}{2}$ inches (6.35 cm.). This increased projection of the floor with its backward displacement and elongation appears to be due entirely to the thinning of the sacral segment in response to the distention

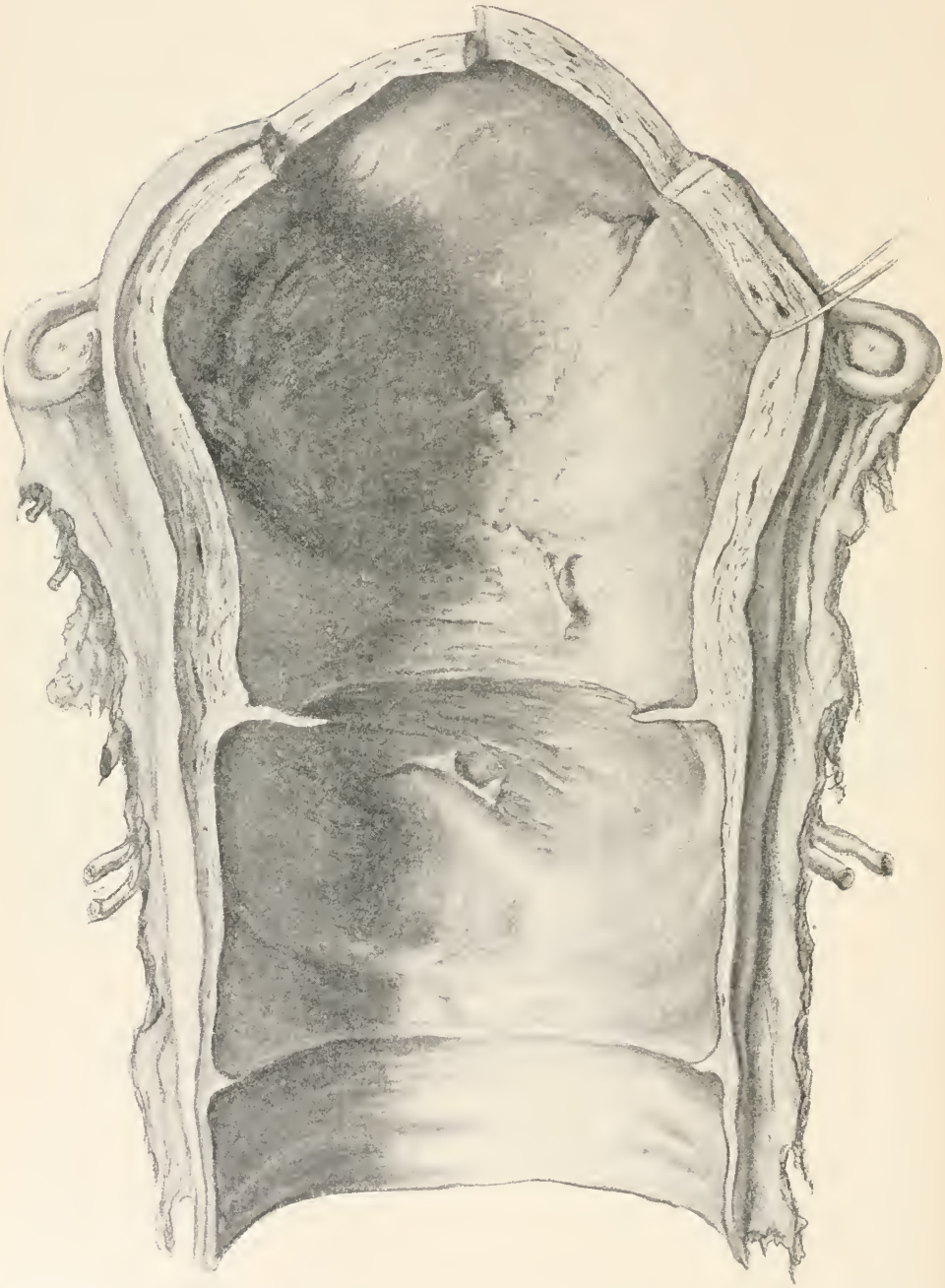

FIG. 531.—UTERUS AND VAGINA FROM A CASE OF SUDDEN DEATH FROM ECLAMPSIA NEAR THE END OF THE SECOND STAGE OF LABOR. Note the retraction ring; the external os, the thickness of the uterine walls of the upper and lower uterine segments, and the region of the internal os.—(*Author's case at the Emergency Hospital.*)

of the fetal head. While the perineum is almost three inches in thickness at term, it is but an eighth of an inch thick at the moment of expulsion.

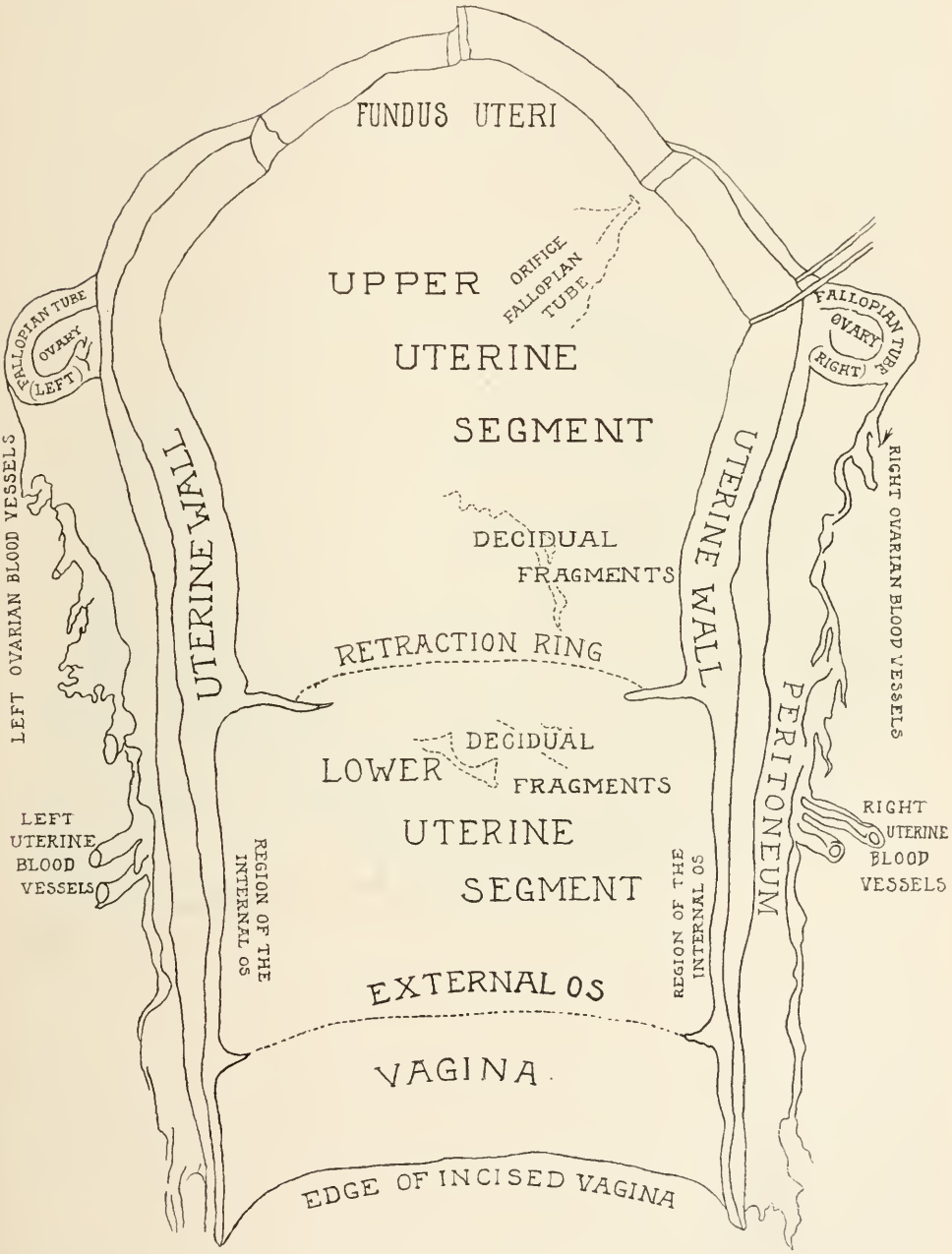

FIG. 532.—OUTLINE OF FIG. 531 WITH EXPLANATORY TITLES.

Parturient Canal as a Whole.—This structure consists of an actively contracting uterus in the shape and position which it assumes in virtue of its ascent

in the abdominal cavity; and the passive portions, namely, vaginal and vulval, which complete the canal and form a pronounced curve with a short anterior and long posterior aspect (Fig. 516). The former is equivalent to the anterior uterine wall and the posterior surface of the symphysis plus the soft parts which lie in front of the pubic bone, and the latter to the concavity of the posterior uterine wall, the sacrum and coccyx plus the stretched and elongated perineum. If each of these surfaces, the shorter anterior convex and the long posterior concave, is divided into a given number of equivalent segments, and the points which correspond on each surface are cut through by planes, an imaginary line passing through the center of each of these planes will describe a certain curve which is not the arc of a circle (Fig. 517). This curve represents the axis of the birth canal, and must be described or followed by the center of any solid mass which is forced through this passage. Numerous attempts have been made to represent the various angles of inclination, axes, and curves of the birth tract, but a total lack of agreement exists in the views of obstetricians on this geometrical problem. In 1828 Carus attempted to show that the parturient axis should be regarded, for practical purposes, as the arc of a circle, the center of which was represented by the center of the posterior surface of the symphysis. In this sense Carus's curve was understood by Meigs, Tarnier, and others. But Carus states himself that the actual curve is not the arc of a circle, but a so-called curve of the higher order, such as form the subject-matter of Cartesian or analytic geometry. He intimates that he has determined the formula for such a curve, and refers the reader to an inaccessible work upon the skeleton. The arc of a circle appears to represent the curve to the parturient canal in the drawings attributed to Krause, and Moreau and Jacquemier, as cited in Varnier's analytic study of labor.* In addition to difference of opinion as to the parturient curve, authors do not agree as to the axis of the parturient uterus and superior strait. While many speak of these axes as one and the same, Faraboeuf and Varnier regard them as distinct. With this last view I am in accord.

II. THE FETUS.

Although it is now well known that during parturition the child is entirely inactive, and so offers itself as a passive factor only, nevertheless certain parts of the child do indirectly exert a modifying influence on child-birth. Obstetrically considered, the fetus is made up of a head and a trunk, and constant reference is made to the vertex, occiput, bregma, brow, and chin of the head, and to the shoulders and pelvis or breech of the trunk (Figs. 533 to 550). While the bulkiest part of the fetus in its normal attitude or posture is the trunk (see Attitude), still the head is least compressible, and so, obstetrically, is larger than the trunk during the passage of the fetus through the pelvis, because it offers the principal resistance. The head is much larger in proportion to the trunk in the fetus than in the adult (Fig. 545).

The Fetal Head.—Because it is least compressible, it is the most important factor in the mechanism of labor. Still, it is yielding to a certain degree, as is shown by the change in shape, which varies according to the diameters in which the compressing force is applied (See Moulding.) The fetal brain will endure with impunity much compression and change in shape and volume, particularly as

* "Obstétrique Journalière," 1900.

regards the hemispheres. The solidity of the bones at the base of the skull protects the ganglia in that region. At term the shape of the fetal head is oval; the two parts of the frontal bone are not closely united at birth and the incompressible base and the compressible vault can be most clearly compared by making a section through the skull parallel with the coronal suture just a little posterior to it and passing through the parietal eminences and the mastoid processes The bones of the base are solid and compactly ankylosed; the compressible vault consists of flexible, semi-cartilaginous laminæ, which are, except the frontal bone, united to the base and to each other by membrane alone The face of the child as compared with that of the adult is remarkably small in propor-

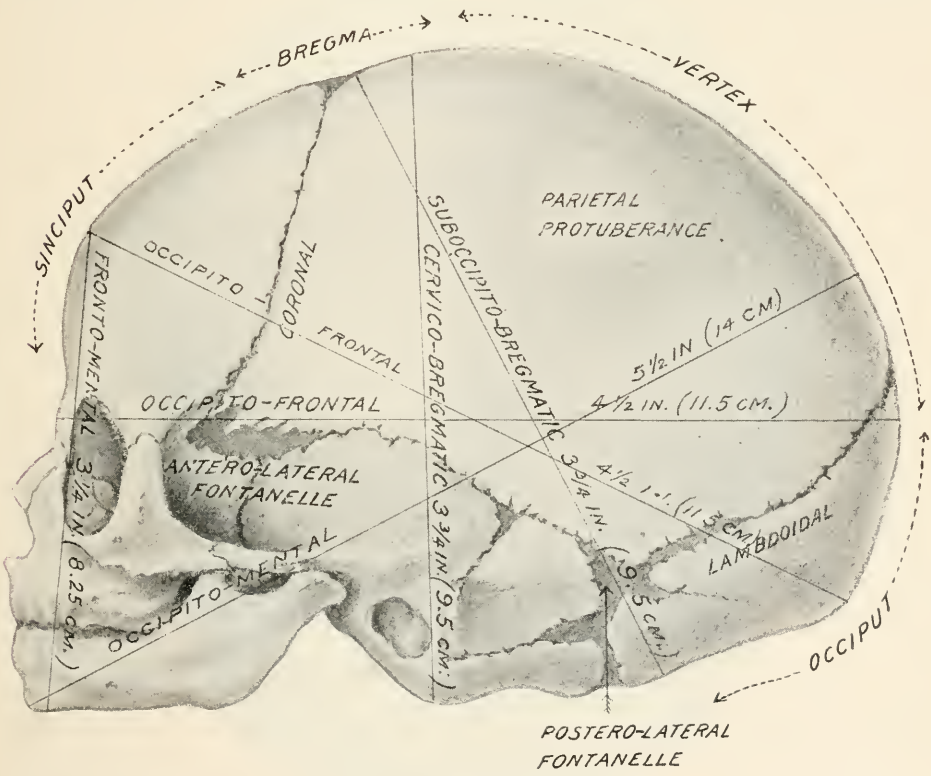

FIG. 533.—DIAMETERS AND LANDMARKS OF THE FETAL SKULL. LATERAL SURFACE.

tion to the cranium. The lower jaw particularly differs from that of the adult; there are no teeth, and, the ramus being short and oblique, the lower maxilla approaches closely to the upper, bringing the angle of the chin very near to the center of the forehead, and rendering the distance from the tip of the chin to the root of the nose not more than 1¼ to 1½ inches (3.17 to 3.75 cm.).

REGIONS AND PROTUBERANCES.—The *occiput* is the region of the fetal head behind the posterior fontanelle including and surrounding the external occipital protuberances (Fig. 533). The *vertex* is the region between the anterior and posterior fontanelles and is bounded laterally by the parietal protuberances. The *bregma* is the anterior fontanelle. The *sinciput*, or *brow*, is the region immediately in front of the bregma and including the anterior portions of the two primitive halves of the frontal bones (Fig. 533). We find

five protuberances upon the fetal head which are important as obstetric bony landmarks. The *occipital protuberance* is situated at about the middle of the occipital bone and an inch posterior to the posterior fontanelle (Fig. 535). The *parietal protuberances* are situated at the center of the parietal bones (Fig. 533). The *frontal protuberances* are situated at the center of the frontal bones (Fig. 536).

Bones.—The bones composing the vault of the head are the two frontal, two

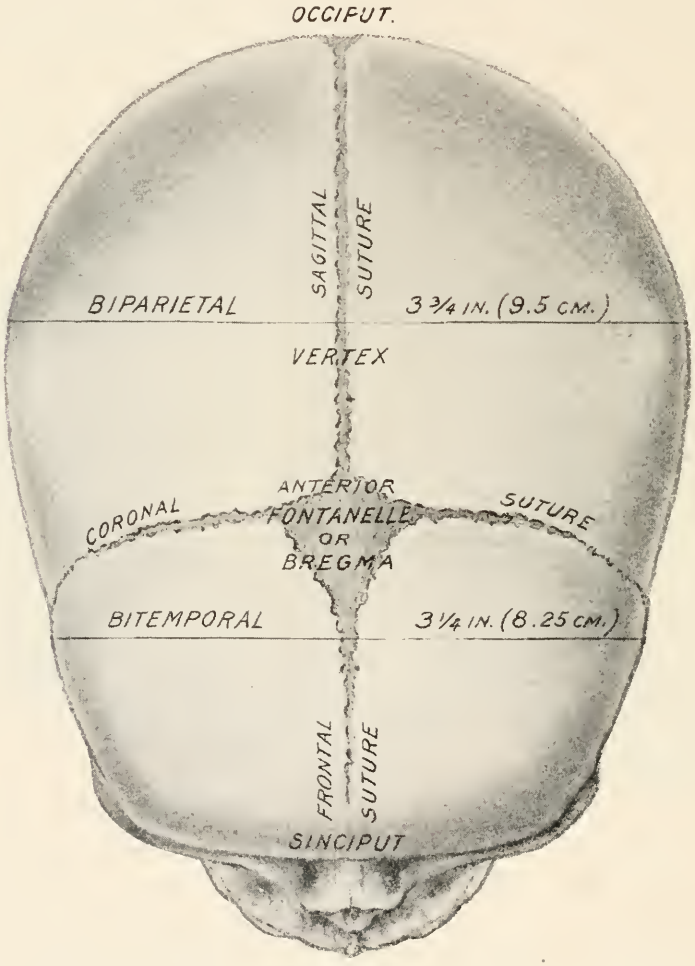

Fig. 534.—Diameters and Landmarks of the Fetal Skull. Upper Surface.

temporal, two parietal, and the occipital. The squamous portions of the fetal skull form such small parts of this vault that they need not be considered (Fig. 533). From the standpoint of obstetrics, the base consists of an incompressible bony mass comprising the face and inferior maxilla, ossification being further advanced here. The compressible vault is attached behind and above. Occasionally one finds supernumerary bones in the interparietal space; they are caused by irregular ossification, and are termed Wormian bones.

Sutures.—The membranous portions between the bones constitute the

sutures, which are named according to the bones which they join and the positions which they occupy. The sutures are not dovetailed, but are separated one from another. The *frontal suture* unites the two frontal bones; the *coronal or fronto-parietal* sutures join the two frontal with the two parietal bones; the great, *sagittal*, or biparietal suture unites the two parietal bones; and the *lambdoid* (deriving its name from the likeness of its shape to the Greek letter Λ), or occipito-parietal, joins the occipital and the two parietal bones. Besides these there are two others: the *temporal or squamous sutures*, which are not factors in the mechanism of labor, and cannot usually be palpated during the process of the same (Figs. 534 and 536).

Fontanelles.—The point where two or more sutures meet is termed a

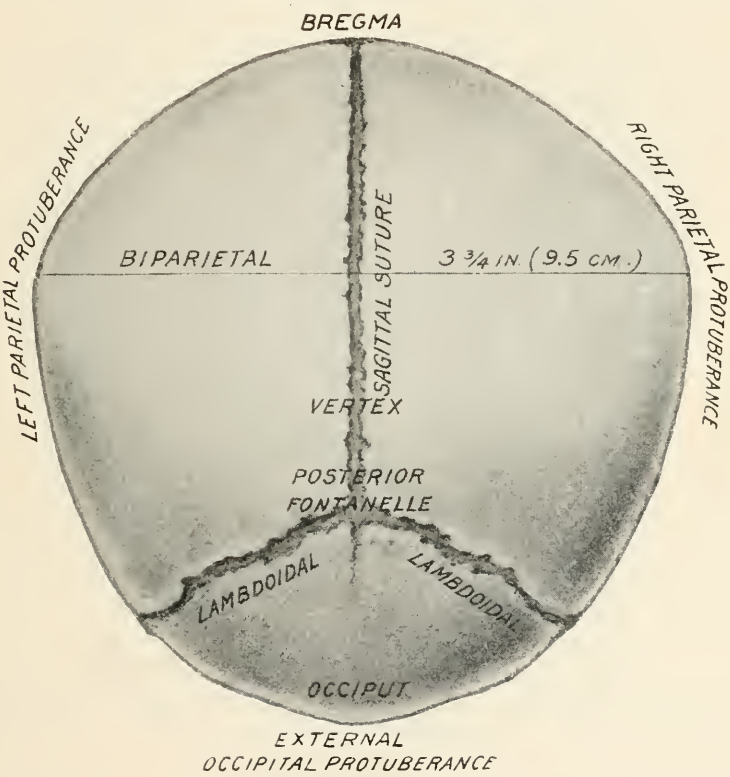

Fig. 535.—Diameters and Landmarks of the Fetal Skull. Posterior Surface.

fontanelle. There are two principal ones, namely: (1) The *anterior or great*, also called the bregma and sometimes the sinciput; this space is diamond- or kite-shaped, and is found at the point of junction of the frontal, coronal, and sagittal sutures. It persists during labor, notwithstanding its somewhat decreased extent caused by the approach of the cranial bones. Four sutures run into it; it averages one inch in diameter and varies widely in size in different fetal heads. (2) The *posterior or small fontanelle*, triangular in shape, is found at the point of junction of the lambdoidal and sagittal sutures. This space does not persist during labor, being then merely a depression or obliterated by the overlapping of the occiput by the parietal bones. Three lines of sutures run into it. Not infrequently by reason of advanced ossification this fontanelle is absent.

(3) The *temporal fontanelles* are found at the anterior and posterior extremities of the inferior border of each parietal bone (Fig. 533). They are irregular in shape and resemble somewhat the occipital fontanelle, and may possibly be mistaken for it during labor in cases of lateral obliquity of the fetal head (see Part V). (4) *False fontanelles* are occasionally seen either along the line of a suture or in the body of a bone, and are due to imperfect or irregular ossification. They may be mistaken for the principal fontanelles. In my collection of 34 full-term skulls well-marked false fontanelles appear in 4 instances, or 11.1 per cent.; in 33 premature skulls in 5 instances, or 15.1 per cent. (Fig. 439).

Movements of the Fetal Head Upon the Spinal Column.—*Complete Flexion.*—The head may so bend upon the child's chest that the chin and sternum

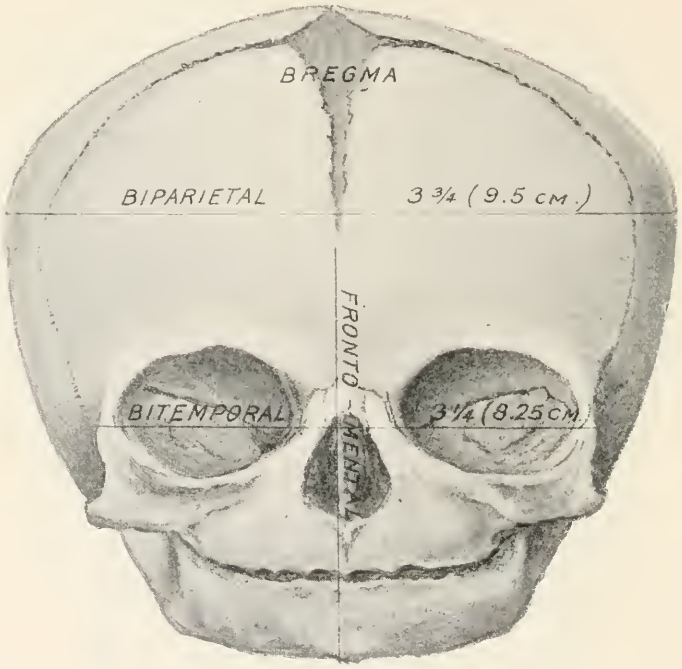

Fig. 536.—Diameters and Landmarks of the Fetal Skull. Anterior Surface.

touch each other, giving the condition of complete flexion. The movement of flexion is really rotation of the head on a transverse axis.

Incomplete Flexion.—In certain cases when the head is at the pelvic brim and in the third or fourth vertex position, flexion is either partly or entirely wanting. Sometimes this condition results from the usual forces not exerting their normal degree of action. Imperfect vertical flexion in a flat pelvis will be referred to again (Fig. 539).

Complete Extension.—Again, the head may be bent backward so that the occipital protuberance touches the cervical spines without doing any injury to the vessels or ligaments of the neck and giving the condition of complete extension (Fig. 539). These movements are believed to take place principally in the cervical vertebræ, the occipito-atlantoid articulation taking little or no part in them. Antero-posterior motion in some instances certainly amounts to as much as 115 degrees. The term *incomplete extension* explains itself.

Rotation.—The occipito-atlantoid articulation furnishes the mechanism for a very important movement—that of rotation; rotation that allows the vertex to move from one point in the pelvis to another, and yet not necessarily requiring the shoulders to follow this movement. The question as to how great a degree of rotation of the head upon the spinal column may take place with safety to the child has been the subject of much dispute among obstetricians. Most of them agree that rotation in the arc of a circle consisting of 90 degrees may occur without any injury to the child (Fig. 539), and Tarnier even goes so far

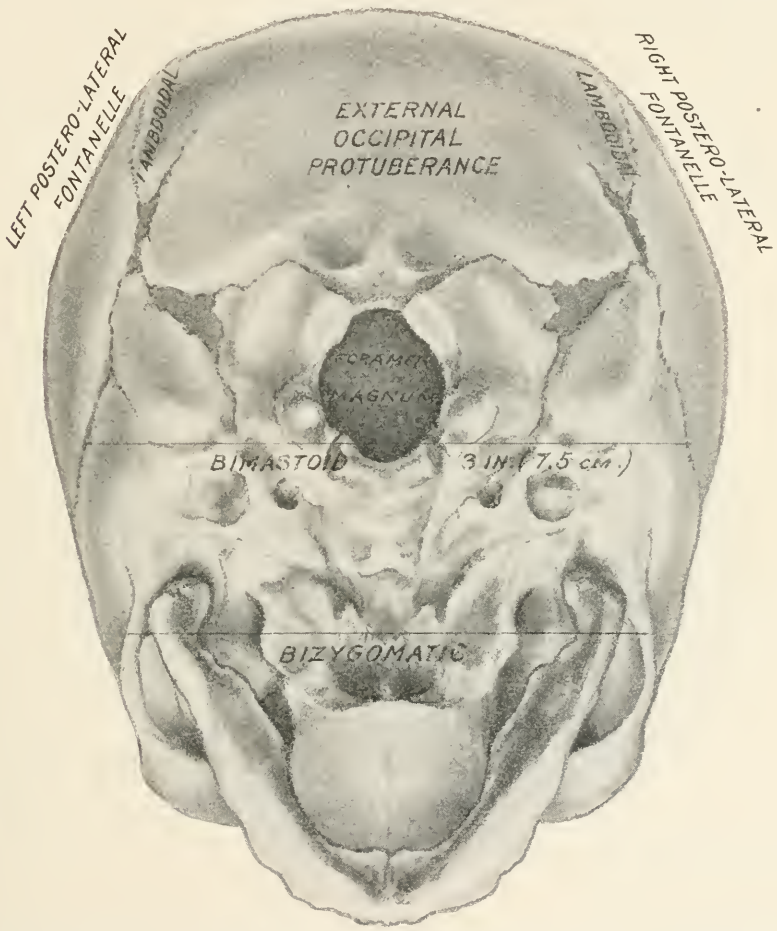

FIG. 537.—DIAMETERS AND LANDMARKS OF THE FETAL SKULL. INFERIOR SURFACE.

as to say that rotation in the arc of a semicircle may be made to occur without injury. In this case the child's face would look directly backward over its spinal column. From experiments with fetal cadavers I find that this rotation or torsion is not confined to any single point or joint, but is distributed along the upper spinal vertebræ. Ninety-degree rotation of the fetal head during labor often occurs without injury to the neck. Fig. 539 is one of several photographs of living children I have taken within an hour of delivery to prove the harmlessness of ninety-degree rotation of the fetal head. In the present case a hundred degrees was easily obtained.

Lever Action of the Fetal Head.—The head is not evenly balanced upon the spinal column. It forms a lever, the chin end of which is the longer, the occipital end the shorter, so that this anterior or chin arm tends to fall when the head is balanced upon the condyles. The importance of this fact will be more manifest when the mechanism of labor is discussed (Fig. 578).

Moulding.—The result of the pressure of the birth canal upon the fetal skull is to diminish the capacity of the whole cranium. This is brought about by: (1) The approximation and overlapping of the bones of the vertex. The bones of the calvarium are not merely joined by membrane, as was stated before, but there is considerable opportunity for overlapping under pressure, since (*a*) they ossify late; (*b*) they are separated by sutures and fontanelles which permit of overlapping; (*c*) and they are so thin as to admit of bending and moulding. Overlapping in the process of labor always takes place in a systematic manner. The parietal bones overlap the frontal and the occipital bones, and the parietal bone which is submitted to the greater pressure—that is, always the one which lies posterior in the pelvis—slides under its fellow. (2) The cerebrospinal fluid is squeezed out of the head into the spinal canal. (3) The blood is also forced out of the cerebral vessels, to a certain extent. (4) Then, too, the brain substance itself in the fetus is but slightly developed, and is therefore capable of being compressed and moulded to a considerable degree without any permanent damage to the fetus. As the fetal head descends lower and lower into the pelvis it becomes subjected to an increasing degree of compression and moulding. Moulding is further assisted by the hinge produced by the non-ossification of the triangular portion of the occipital bone with the basilar portion.

FIG. 538.—ANTERO-POSTERIOR MOVEMENTS OF THE FETAL HEAD UPON THE BODY. Complete flexion; incomplete flexion, incomplete extension; complete extension.

DIAMETERS OF THE FETAL HEAD (Figs. 533 to 537).—For the purpose of judging of the changes of shape in the head, and of comparing the head with the pelvic dimensions, there are numerical measurements of certain diameters of the fetal skull. Problems in the mechanism of labor concern not only the size but the shape of the fetal head, and these are best understood, studied, and described by the aid of diameters and circumferences taken at different planes. The most important diameters in case of pelvic deformity are those of the base, since they are incompressible. But those to be dealt with in the usual case of labor are those having at least one extremity on the vault of the skull, and therefore capable of being shortened. The incompressible diameters are (1) the bimastoid; (2) the bimalar; (3) the bitemporal. The fetal head

diameters include (1) the occipito-mental; (2) the occipito-frontal; (3) the sub-occipito-frontal; (4) the suboccipito-bregmatic; (5) the biparietal; (6) the bitemporal; (7) the bimalar; (8) the bimastoid; (9) the fronto-mental; (10) the cervico- or trachelo-bregmatic.

1. The *occipito-mental diameter*, O. M., $5\frac{1}{2}$ inches (14 cm.), is the greatest distance from the center of the lower margin of the chin to a point on the posterior extremity of the sagittal suture.

FIG. 539.—ROTATION OF THE FETAL HEAD UPON THE BODY. The illustration is from one of several photographs taken of living children within an hour after delivery to prove the harmlessness of 90 degrees or even greater rotation of the fetal head upon the body. This photograph shows 110 degrees rotation.—(*Photograph taken by the author at the Emergency Hospital.*)

2. The *occipito-frontal diameter*, O. F., $4\frac{1}{2}$ inches (11.5 cm.) is measured from the apex of the occipital protuberance to the root of the nose.

3. The *suboccipito-frontal diameter*, S. O. F., $4\frac{3}{8}$ inches (11 cm.), extends from the junction of the neck and occiput to the root of the nose.

4. The *suboccipito-bregmatic diameter*, S. O. B., $3\frac{3}{4}$ inches (9.5 cm.), is measured from the junction of the nucha and the occipital bone to the center of the anterior fontanelle.

5. The *biparietal diameter*, BI P., $3\frac{3}{4}$ inches (9.5 cm.), is the widest distance between the parietal protuberances.

6. The *bitemporal diameter*, T. T., $3\frac{1}{4}$ inches (8.25 cm.), is the distance between the anterior ends of the coronal sutures.

7. The *bimalar diameter*, M. M., 3 inches (7.5 cm.), is the greatest distance between the malar tuberosities.

8. The *bimastoid diameter*, 3 inches (7.5 cm.), is the widest distance between the mastoid apophyses.

9. The *fronto-mental diameter*, F. M., $3\frac{1}{4}$ inches (8.25 cm.), is measured from the summit of the forehead to the center of the lower margin of the chin.

The mento-frontal diameter cannot be estimated, as the frontal bone offers no fixed point which would serve as one extremity. However, an approximate measurement might be stated to be about 3 inches (7.5 cm.), one-half of which would span the distance between the glabella * and chin.

10. The *cervico- or trachelo-bregmatic diameter*, $3\frac{3}{4}$ inches (9.5 cm.), extends from the junction of the neck and chin to the center of the anterior fontanelle.

These are average measurements taken from many thousand heads, eliminating as far as possible alterations in shape due to moulding of the head in its journey through the pelvis, for even after easy labors, with perfectly normal vertex presentations, the diameters of the child's head after delivery will be decidedly different in relative length from those which have just been mentioned. While these changes in length are usually only relative, yet they may at the same time be absolute, chiefly affecting the occipito-mental and occipito-frontal diameters. These are increased while all the others are diminished, especially the suboccipito-bregmatic and the biparietal. The diameters are of value in that they indicate the circumference of the plane of the skull in which they are taken. As has been stated, the general shape of the head is roughly ovoid, or spheroidal, so that a reasonable idea may be obtained of the mass under comparison. The approximate measurements of the more important diameters of the fetal head for ease in memorizing and for practical purposes may be stated as follows:

Occipito-mental, ... $5\frac{1}{2}$ inches (14 cm.)	Fronto-mental, . . . $3\frac{1}{2}$ inches (9 cm.)
Occipito-frontal, ... $4\frac{1}{2}$ inches (11 cm.)	Biparietal, ... $3\frac{1}{2}$ inches (9 cm.)
Sub-occipito-bregmatic . $3\frac{1}{2}$ inches (9 cm.)	Bitemporal, ... $3\frac{1}{4}$ inches (8.25 cm.)

Planes and Circumferences of the Fetal Head.—Again, we study the shape and size of the fetal head by means of planes or cross-sections corresponding to its diameters, in the same way as we study the pelvis by means of horizontal planes at different levels.

1. The *occipito-mental plane* (Fig. 541). This section passes through the occipito-mental and biparietal diameters; its shape is irregular and oval; its circumference is the greatest circumference of the fetal head and equals 15 inches (38 cm.).

2. The *occipito-frontal plane* (Fig. 543). This section passes through the biparietal and the occipito-frontal diameters; it is irregularly oval in shape; its circumference is $13\frac{3}{4}$ inches (35 cm.).

3. The *suboccipito-frontal plane* (Fig. 542). This plane passes through the bitemporal and suboccipito-frontal diameters; it is also oval and irregular in shape; its circumference is 12 inches (30 cm.).

4. The *suboccipito-bregmatic plane* (Fig. 540). This section passes through the biparietal and suboccipito-bregmatic diameters. This plane is the smallest

* Glabella, "the space between the eyebrows."

of all the head planes; is nearly circular in shape, and is the plane which, in normal vertex presentations and complete flexion of the head, is successively in relation with all the pelvic planes from the inlet to the outlet of the parturient canal. Its circumference, after moulding of the head, is 11 inches (28 cm.). A study of these cephalic planes and circumferences shows that the circumference of the suboccipito-bregmatic plane is the smallest, and that of the occipito-mental is the greatest of the fetal head circumferences; that any

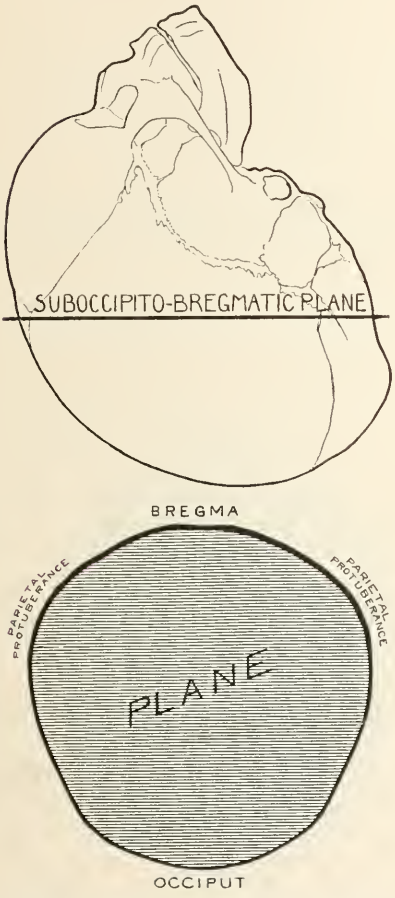

FIG. 540.—LINE OF SECTION AND SHAPE OF SUBOCCIPITO-BREGMATIC PLANE. —(*Author's lead-tape tracing.*)

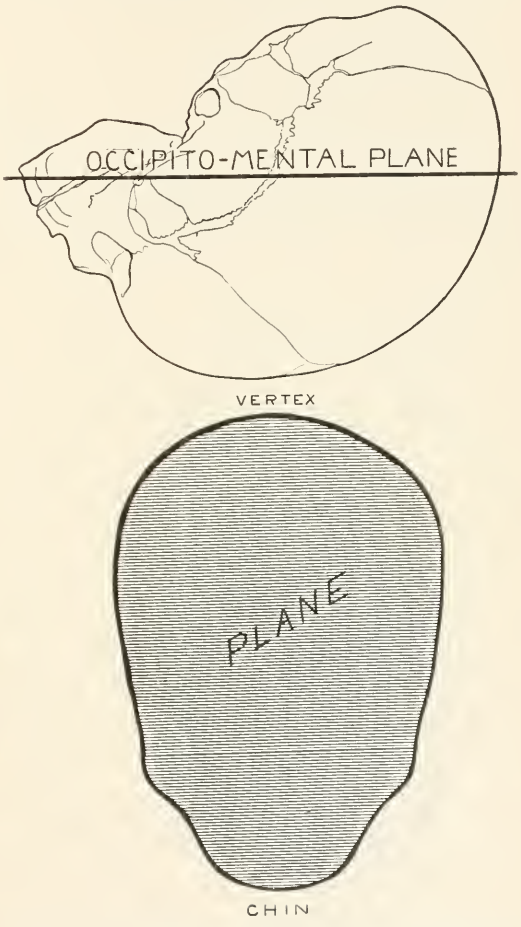

FIG. 541.—LINE OF SECTION AND SHAPE OF OCCIPITO-MENTAL PLANE.—(*Author's lead-tape tracing.*)

departure from the normal attitude of complete flexion of the head, whereby the head is partly extended, increases the circumference of the presenting part anywhere from 11 to 15 inches, according to the degree of head extension; thus making all the difference between an easy, normal labor and complete obstruction due to a too great fetal head circumference presenting.

TRUNK MEASUREMENTS.—The measurements of the trunk are unimportant in average-sized fetuses, because all the diameters are compressible and offer little obstacle to delivery (Figs. 544 to 550).

1. The *bisacromial diameter*, A. A., $4\frac{3}{4}$ inches (12 cm.), is the greatest distance between the acromial processes. It is readily compressible an inch.

2. The *bitrochanteric diameter*, T. T., $3\frac{1}{2}$ inches (9 cm.), is the widest distance between the trochanters.

3. The *dorso-sternal diameter*, D. S., $3\frac{3}{4}$ inches (9.5 cm.), is an antero-posterior diameter at the level of the shoulders.

4. The *sacro-pubic diameter*, $2\frac{1}{8}$ inches (5.5 cm.), is the antero-posterior

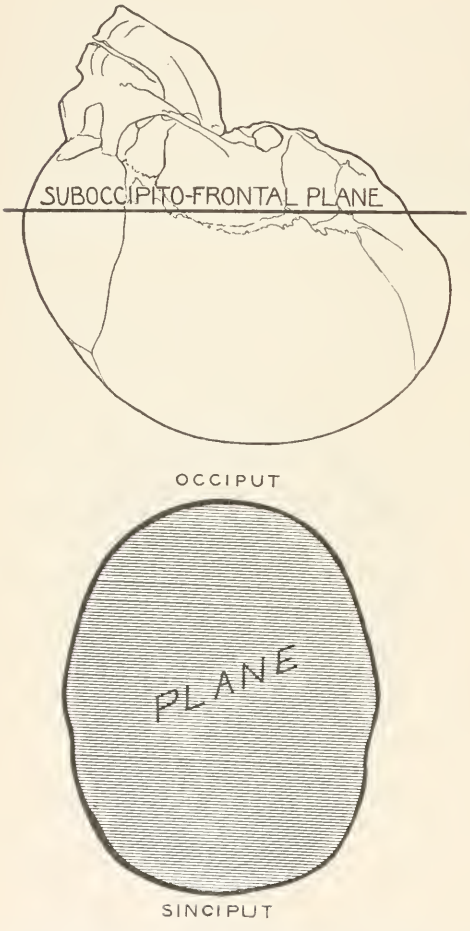

FIG. 542.—LINE OF SECTION AND SHAPE OF SUBOCCIPITO-FRONTAL PLANE.—(*Author's lead-tape tracing.*)

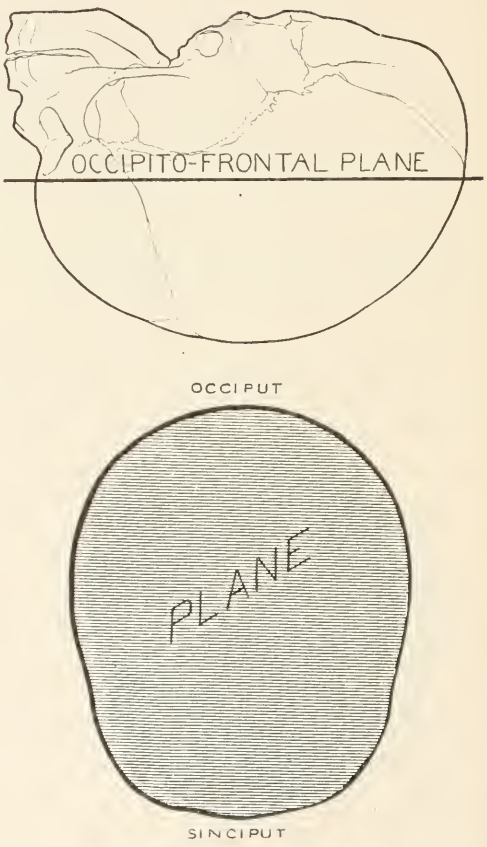

FIG. 543.—LINE OF SECTION AND SHAPE OF OCCIPITO-FRONTAL PLANE.—*Author's lead-tape tracing.*)

diameter of the fetal pelvis. Flexion of the thighs upon the abdomen doubles this diameter, making it $4\frac{1}{4}$ inches (11 cm.); it is then compressible an inch or more.

5. The *vertico-podalic diameter*, V. P., $9\frac{1}{2}$ to 10 inches (24.13–25.4 cm.), is the length of the fetal ellipse, and is the greatest distance from the vertex to the breech.

6. The *bisacromial circumference*—namely, a circumference corresponding to the bisacromial diameter—is 13 inches (33 cm.) (Fig. 547). This is compressible several inches.

Planes and Circumferences of the Fetal Trunk.—The *bisacromial plane* is oval with its long axis transverse (Fig. 547). The *midplane of the fetal ellipse* is an important one, and but rarely, if ever, referred to in works on obstetrics (Fig. 544). It is a plane passing through the center of the fetal body and including in its circumference the knees, elbows, and umbilical cord. Its shape is generally oval, and its long axis antero-posterior as regards the fetal body. The *bitrochanteric with extended thighs* is oval with a longer transverse diameter (Fig. 550). When the *thighs are flexed* on the body a more round shape obtains (Fig. 549).

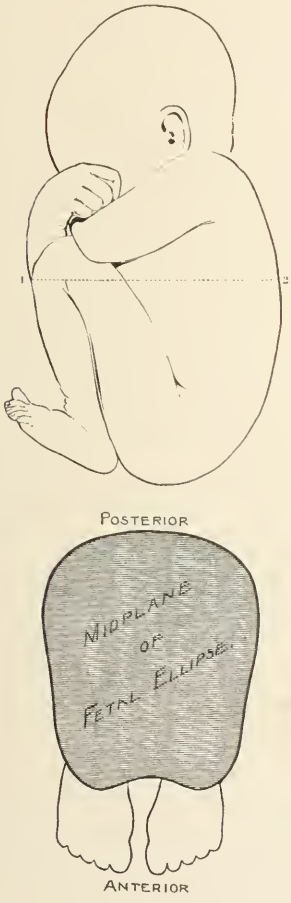

Fig. 544.—Lateral Surface of the Normal Fetal Ovoid, or Ellipse, showing also the Line of Section (1, 2) and the Shape of the Midplane of the Fetal Ellipse.—(*Author's lead-tape tracing.*)

Fig. 545.—Anterior View of the Normal Fetal Ovoid or Ellipse.

Length and Weight of the Fully Developed Fetus.—At the fortieth week, or full term, the total length from heels to vertex varies from 18.9 to 20.47 inches (48 to 52 cm.); the vertex-coccygeal length being about one-half of this. The average weight is 6.60 to 7.92 pounds (3000 to 3600 grams); males weighing somewhat more than females and the first child less than subsequent children, this progressive gain in weight, however, being true only

till the fourth or fifth child. It must be remembered that variations in the weight of the mature fetus occur from 6 to 12 pounds (2700 to 5400 grams); in very rare instances 12 pounds (5400 grams) has been exceeded, and weights up to 20 pounds (9000 grams) have been observed.

Attitude or Posture.—A practical point in connection with the part the child plays in the process of labor has to do with (1) the manner in which the

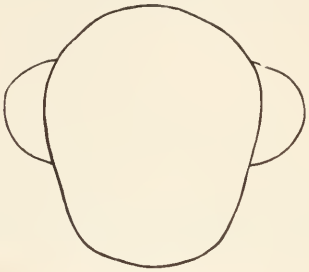

FIG. 546.

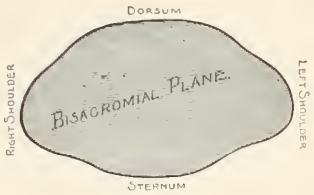

FIG. 547.

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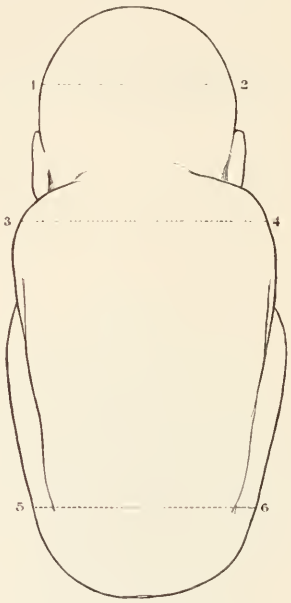

FIG. 549.

FIGS. 546–549.—FIG. 546 SHOWS THE RELATION OF THE LONG HEAD DIAMETER TO THE LONG SHOULDER DIAMETER, THEY BEING AT RIGHT ANGLES TO EACH OTHER. FIG. 547 SHOWS THE SHAPE OF THE BISACROMIAL PLANE.—(*Author's lead-tape tracing.*) FIG. 548 GIVES THE POSTERIOR VIEW OF THE FETAL OVOID OR ELLIPSE, SHOWING LINES OF SECTION OF BISACROMIAL PLANE (3, 4) AND BITROCHANTERIC PLANE WHEN THE THIGHS ARE FLEXED (5, 6). FIG. 549 GIVES THE SHAPE OF THE BITROCHANTERIC PLANE, WHEN THE THIGHS ARE FLEXED.—(*Author's lead-tape tracing.*)

child is placed in the uterus as regards the relationship existing between its own parts, and (2) the relationship existing between it and the uterus and pelvis.

Attitude or posture designates the relation which the different parts of the fetus bear to each other. In the normal attitude the body is flexed upon itself, rendering the back arched so as to form a convexity backward (Fig. 545). It has been shown that from the earliest period the embryo tends to curve upon itself, and this flexion persists throughout intra-uterine life (Fig. 134). The head is bent upon the sternum; the forearms are crossed or are near one another upon the chest; the thighs and legs are flexed so as to bring the knees

near the elbows and the feet near the buttocks or breech; the dorsum of the foot being somewhat flexed on the leg and the soles of the feet turned a little inward; the umbilical cord is generally found in the space between the arms and legs, although it may be wound about the neck or body of the child from one to several times (Fig. 134). This is the attitude of the later months, but in the earlier months, when there is a relatively greater amount of liquor amnii, the fetus is not in such a compact mass, nor are the extremities so near one another.

The Fetal Ovoid, or Ellipse.—In considering the whole body of the fetus, it may be regarded as presenting roughly an ovoid mass which is made up of two parts, head and trunk, both of the same general shape—ovoid. In normal mechanism the long axis of the whole mass is almost parallel with the axis of the birth canal, and the two axes of the two masses respectively, head and body, are nearly parallel, one to the other. The trunk and breech of this fetal ovoid, or ellipse, are bulkier and require more room than does the head, which latter, after moulding, is comparatively pointed (Fig. 544). It must also be remembered that the fetal ovoid is flattened from side to side; that its greatest transverse diameter is an antero-posterior one at about its center or midplane, and measured from the spine to the region of the flexed arms, legs, thighs, and the coiled-up cord (Fig. 544). Attitude is caused chiefly by the tonic action of the flexor muscles, for they, being the stronger, predominate over the extensors, and the primitive attitude of the embryo persists. The shape of the uterus also offers an etiological factor. According to Pajot's law of accommodation: "When a solid body is contained in another, if the container is the seat of alternate movement and rest, if the surfaces are slippery and not angular, the contained constantly tends to accommodate its form and dimensions to the form and capacity of the container." After delivery a child will be seen to assume naturally the prenatal attitude and yet it is free to move in any direction. Faulty attitude during labor may cause many complications, such as incomplete flexion or bregma presentation; brow and face presentations; lateral flexion of the head and prolapse of arms, legs, and cord. (See Fetal Dystocia, Part V.)

FIG. 550.—ANTERIOR VIEW OF FETUS WITH EXTENDED ARMS AND LEGS. Shows line of section (3, 4) and shape of bitrochanteric plane when thighs are extended.—(*Author's lead-tape tracing.*)

Presentation.—The term presentation is used to designate that portion of the child showing itself most prominently at the os uteri, in the vagina, or at the vulva, or it is the relationship of the long axis of the child to the long axis of the uterus.

Table of Pelvic and Fetal Measurements.

INTERNAL MEASUREMENTS OF THE BONY PELVIS

	Antero-posterior Diameters.	Oblique Diameters.	Transverse Diameters.	Circumferences.
Inlet,	4¼ in. (11 cm.).	5 in. (12.5 cm.).	5¼ in. (13.5 cm.).	16 in. (40.5 cm.).
Middle plane of cavity,	5 in. (12.5 cm.).	4¾ in. (12 cm.).	4¾ in. (12 cm.).	
Outlet,	3¾–4¾ in. (9.5–12 cm.).		4¼ in. (11 cm.).	18 in. (45 cm.).

Depth of the true pelvis in front is 1⅝ in. (4 cm.); posteriorly 4½ to 5 in. (11.5 to 12.5 cm.); lateral walls 3½ in. (9 cm.). These measurements of the bony pelvis are lessened by the muscles and tissue of the soft parts ¼ to ½ inch (0.635 to 1.27 cm.).

CLINICAL MEASUREMENTS OF THE PELVIS.

Interspinal diameter,	(Fig. 203)	10 inches	(25.5 cm.).
Intercristal diameter,	(Fig. 204)	11 inches	(28 cm.).
Bitrochanteric diameter,	(Fig. 204)	12½ inches	(31 cm.).
External conjugate diameter,	(Fig. 206)	8 inches	(20.25 cm.).
Right and left external oblique diameters,	(Fig. 205)	8¾ inches	(22 cm.).
Diagonal conjugate diameter,	(Fig. 209)	5 inches	(12.5 cm.).
True conjugate diameter,	(Fig. 214)	4½ inches	(11.5 cm.).
Transverse of inlet diameter,	(Fig. 216)	5¼ inches	(13.5 cm.).
Sacropubic conjugate of outlet diameter.	(Fig. 208)	4¾ inches	(12 cm.).
Bisischial diameter,	(Fig. 210)	4¼ inches	(11 cm.).
External circumference of pelvis,		35½ inches	(88.75 cm.).

FETAL HEAD MEASUREMENTS (Figs. 533 to 537).

Occipito-mental diameter,	5½ inches	(14 cm.).
Occipito-frontal diameter,	4½ inches	(11.5 cm.).
Suboccipito-bregmatic diameter,	3¾ inches	(9.5 cm.).
Biparietal diameter,	3¾ inches	(9.5 cm.).
Bitemporal diameter,	3¼ inches	(8.25 cm.).
Bimastoid diameter,	3 inches	(7.5 cm.).
Fronto-mental diameter,	3¼ inches	(8.25 cm.).
Cervico-bregmatic diameter,	3¾ inches	(9.5 cm.).

Occipito-mental circumference,	(Fig. 541)	15 inches	(38 cm.).
Occipito-frontal circumference,	(Fig. 543)	13¾ inches	(35 cm.).
Suboccipito-frontal circumference,	(Fig. 542)	12 inches	(30 cm.).
Suboccipito-bregmatic circumference,	(Fig. 540)	11 inches	(28 cm.).
Biparietal circumference,	(Fig. 540)	12 inches	(30 cm.).

FETAL TRUNK MEASUREMENTS.

Bisacromial diameter,	4¾ inches	(12 cm.).
Bitrochanteric diameter,	3½ inches	(9 cm.).
Dorso-sternal diameter,	3¾ inches	(9.5 cm.).
Sacro-pubic diameter,	2⅛ to 4¼ inches	(5.5 to 11. cm.).
Vertico-podalic diameter,	9½ to 10 inches	(24.13 to 25.4 cm.).
Bisacromial circumference,	13 inches	(33 cm.).

Classification of Presentations.	I. *Cephalic*	Vertex, Bregma. Brow, Face. Anterior Parietal Bone, Posterior Parietal Bone. Excessive flexion.
	II. *Pelvic*	Breech.
	III. *Trunk*	Shoulder.
	IV. *Complicated*	Prolapse of cord; one or more arms or legs.
	V. *Multiple*	Head and breech. Two heads, two breeches. Head or breech and shoulder or abdomen.

Relative Frequency.—The frequency of vertex presentations is 96 per cent. of all presentations; the pelvis or breech presents in from 3 per cent. to 4 per cent. of all cases; face presentations occur in 0.5 per cent.; shoulder presentations in 0.5 per cent.; and brow presentations in 0.25 per cent. of all cases.

We have no reliable figures to offer for the relative frequency of complicated and multiple presentations.

Causes of Frequency of Vertex Presentations.—The etiology of the usual presentation,—the vertex,—considered the normal since it is present in 96 per cent. of all cases at full term, is readily understood. It is well established that the head is generally lower than the breech, even from the very first formation of the liquor amnii. It has been shown that in the early months frequent changes occur in the position of the fetus *in utero*, that these changes become less and less marked as full term approaches, until at that period the proportion of head presentations far exceeds in frequency any other. According to Churchill's statistics, head presentations occur in 83 per cent. of living and only 53 per cent. of dead fetuses at seven months. Changes from other presentations to the vertex are more frequent than the converse, and a shoulder is more often changed than a breech, the causes being the shape of the fetus and uterus and uterine contractions.

In 175 miscarriages (third to seventh month) I found the proportion of cephalic and podalic presentations equally divided. In 238 premature children including living, still-born, twins, and still-born and macerated, I found the following:

	Cases.	
Cephalic (vertex) presentation,	129	or 54.20 per cent.
Podalic (breech) presentation,	55	or 23.12 per cent.
Shoulder presentation,	7	or 2.95 per cent.
Not noted on history,	47	or 19.23 per cent.
Total,	238	

In the total number of 238 premature children, including the twenty twin cases:

	Cases.	
Fetus was born living,	114	or 47.89 per cent.
Fetus was still-born,	47	or 19.75 per cent.
Fetus was still-born and macerated,	43	or 18.07 per cent.
Condition not noted on histories,	34	or 14.29 per cent.
Total,	238	

	Vertex.	Breech.	Shoulder.
Living children,	31.50 per cent.	9.24 per cent.	0.84 per cent.
Still-born,	9.24 per cent.	5.88 per cent.	1.26 per cent.
Still-born and macerated,	8.82 per cent.	6.30 per cent.	0 per cent.

This last table shows markedly the predominance of vertex presentations in fetuses born alive (31.50 per cent. vertex, and 9.24 per cent. breech, in living

fetuses; moreover, the sharp decline in the excess of vertex presentations over breech when a still-born or still-born and macerated fetus obtains (9.24 per cent. vertex and 5.88 per cent. breech in the former, and 8.82 per cent. vertex and 6.30 per cent. breech in the latter).

As pregnancy approaches term the presentation becomes progressively more and more stable, and particularly so in primigravidæ, because the head descends lower in the pelvis, and the abdominal walls, being more rigid, prevent movements to any extent.*

Gravity is an important factor in determining the position of the head at the cervix. The fetus is immersed in a fluid not much lighter than itself (liquor amnii, specific gravity 1.01). With these conditions the effect of gravity will depend not upon the position of the center of gravity of the child when suspended in air, but upon the relative specific gravity of the different parts. Matthews Duncan proved that the specific gravity of the head is greater than that of the headless trunk.

Other causes of head presentation exist, and one is the shape of the uterine cavity and the law of accommodation, for the fetus in vertex presentation takes up less room than in any other position. Although in the middle third of pregnancy the pregnant uterus is nearly round, yet in the last third it becomes more and more pear-shaped or pyriform, with the broad part directed upward and the tapering extremity downward. In the study of the fetal ellipse it has been seen that it consists of a broad extremity, the breech, and the narrowed part, the head. In the adaptation of the fetus' body to the uterine cavity, a head or vertex presentation results. Since the uterus is so elastic and contractile, when the long axis of the child lies transverse or oblique, uterine action tends to make it parallel with the long axis of the uterus, accommodating the bulky breech to the roomy fundus and the smaller pointed head and vertex to the narrowed and less roomy lower uterine segment.

Reflex action on the part of the child plays its part in causing the head to lie lowest. In the case of breech presentation the sensitive buttocks and feet are constantly exposed to the jars caused by movements of the mother, as well as to the augmented uterine contractions of the lower part of the uterus caused by the extreme stretching to which it is subjected by a breech in the latter part of gestation.

The intermittent uterine contractions, which increase in force and frequency as gestation advances, help in securing a head presentation, assisted by the shape and attitude of the fetus and the bulk and mobility of the fetal head. The sum of the force of intra-uterine pressure is toward the lower uterine segment, and hence the head, being mobile, is forced down in that direction.

Summary.—The following are the causes of vertex presentation, enumerated in the order of their importance: (1) The shape of the uterine cavity; (2) the shape of the fetal ellipse; (3) the intermittent uterine contractions; (4) the mobility of the fetal head; (5) the direction of intra-uterine force; (6) gravity; (7) reflex action. Alterations in the normal action of any one of these important causes may result in departures from a normal vertex presentation The shape of the uterine cavity may be changed by tumors, pelvic deformity, low implantation of the placenta, hydramnios, and multiple pregnancy. The normal shape of the fetal ellipse may be changed by hydrocephalus,

* Schroeder, however, from observations made in 214 primigravidæ, including four cases of contracted pelvis, found during the last three weeks of pregnancy changes of presentation occurring in 36.4 per cent.

and by tumors of the neck and trunk. Gravity and reflex action are affected by the death of the fetus.

Position.—The term position is used to define the relationship existing between a certain point on the presenting part, and certain other points on the pelvis of the mother. The points on the presenting parts are the occiput in vertex presentations; the sacrum in breech presentations; the chin in face presentations; the frontal bone in brow presentations, and a scapula in shoulder presentations respectively. The four fixed cardinal points on the mother's pelvis are the two acetabula in front and the two sacro-iliac synchondroses posteriorly (Figs. 513 and 514). The positions in all presentations are named numerically, beginning at the left acetabulum and passing to the right, and thus around the pelvis; as the first, second, third, and fourth. There are, therefore, four positions for each presentation, according as the single point on the presenting part corresponds to one of the four cardinal points on the mother's pelvis. For example: in the right mento-posterior position the chin is the point on the presenting part, and the right sacro-iliac synchondrosis is the point on the pelvis of the mother. This is the third position in face presentation.

POSITIONS OF THE FETUS.

VERTEX POSITIONS.

I. Left Occipito-anterior—Occipito Læva Anterior, L. O. A.. 70 per cent.
II. Right Occipito-anterior—Occipito Dextra Anterior, R. O. A., 10 per cent.
III. Right Occipito-posterior—Occipito Dextra Posterior, R. O. P., 17 per cent.
IV. Left Occipito-posterior—Occipito Læva Posterior, L. O. P., 3 per cent.

FACE POSITIONS.

I. Left Mento-anterior—Mento Læva Anterior, L. M. A., second in frequency.
II. Right Mento-anterior—Mento Dextra Anterior, R. M. A., third in frequency.
III. Right Mento-posterior—Mento Dextra Posterior, R. M. P., most common.
IV. Left Mento-posterior—Mento Læva Posterior, L. M. P., fourth in frequency

BROW POSITIONS.

I Left Fronto-anterior—Fronto Læva Anterior, L. F. A.
II. Right Fronto-anterior—Fronto Dextra Anterior, R. F. A
III. Right Fronto-posterior—Fronto Dextra Posterior, R. F. P.
IV Left Fronto-posterior—Fronto Læva Posterior, L. F. P.

PELVIC POSITIONS.

I Left Sacro-anterior—Sacro Læva Anterior, L. S. A., most frequent.
II. Right Sacro-anterior—Sacro Dextra Anterior, R S. A.
III. Right Sacro-posterior—Sacro Dextra Posterior, R. S. P., second in frequency.
IV. Left Sacro-posterior—Sacro Læva Posterior, L. S. P.

SHOULDER POSITIONS.

I. Left Scapula Anterior—Scapula Læva Anterior, L. Scap. A., most frequent.
II. Right Scapula Anterior—Scapula Dextra Anterior, R. Scap. A..
III. Right Scapula Posterior—Scapula Dextra Posterior, R. Scap. P.
IV. Left Scapula Posterior—Scapula Læva Posterior, L. Scap. P.

In Germany two positions of the vertex are described: The first vertex position (I Schädellage) is when the occiput lies to the left side of the pelvis, and the second vertex position (II Schädellage) is when it lies to the right. The Germans consider our third and fourth positions to be variations of the first and second. In France four positions are described, as with us, and, in addition, right and left transverse positions, making six in all. In England, as in America, four positions are described. On the Continent of Europe—namely, in France and Germany—and also in America the right oblique diameter of the pelvic inlet starts from the right sacro-iliac synchondrosis and the left from the left. In England, on the contrary, the reverse obtains; namely, the right oblique diameter ends at the right ilio-pectineal eminence, and the left is that which ends at the left eminence.

These are facts which must be remembered in reading German, French, and English works on obstetrics.

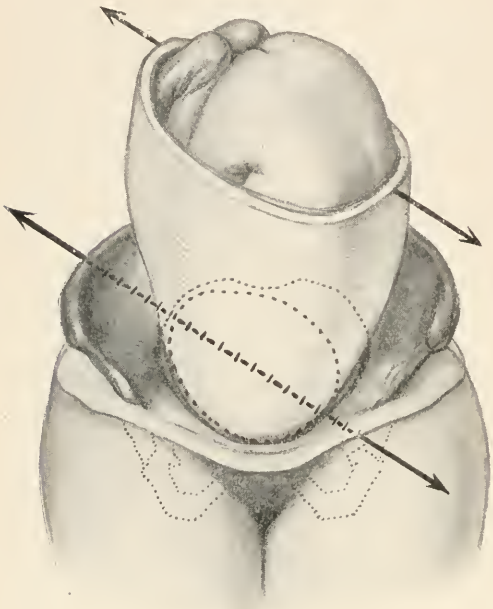

FIG. 551.—AXIAL TORSION OF THE PREGNANT UTERUS AND SHAPE OF THE UTERINE CAVITY. Note that the long transverse diameter of the uterus corresponds to the right oblique pelvic diameter, thus bringing the left border of the uterus and the fetal back (in L. O. A.) toward the anterior abdominal wall. (Compare Figs. 160 and 545.)

Relative Frequency.—In all presentations, with the exception of the shoulder, the first and third positions most frequently obtain. In other words, at the pelvic inlet the long diameter of the presenting part lies in a diameter of the uterus which corresponds to the right oblique diameter of the pelvic inlet, with the dorsum of the fetus directed to the left and anterior or to the right and posterior. In vertex presentations the first position obtains in 70 per cent. of cases, the second in 10 per cent., the third in 17 per cent., and the fourth in 3 per cent. In face presentations the first position is second in frequency; the second position, third in frequency; the third most common, and the fourth position is fourth in frequency. In shoulder presentations the first position is most common. In pelvic or breech presentations the first is the most frequent and the third is second in frequency.

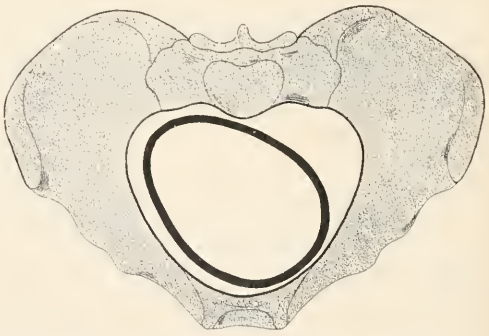

FIG. 552.—AXIAL TORSION OF THE UTERUS AND SHAPE OF THE UTERINE CAVITY.

Explanation of the Frequency of the First Vertex Position.—The anterior part of the cavity of the uterus is better adapted to accommodate the posterior plane of the fetus, while the posterior part, which is encroached upon by the prominent lumbar vertebræ, is more fitted to receive the anterior part of the fetal ellipse. This is why the child's back most usually presents anteriorly. But if for any reason the uterus should be uniformly pear-shaped, and not be pos-

sessed of those peculiarities just mentioned, then the back of the fetus may look to the back, front, or either side (Fig. 551).

We know that the longest horizontal axis of the uterus is a transverse one; in other words, that the uterine cavity in the latter part of pregnancy is flattened from before back (Fig. 137). In this connection also the torsion of the uterus on its longitudinal axis, whereby the left lateral aspect inclines toward the front, must be taken into account (Fig. 551).* The result of axial torsion is to bring the roomy transverse diameter of the uterus into coincidence with the right oblique diameter of the pelvic inlet. A glance at the fetus in its normal posture (Figs. 544 and 545) will show that its greatest horizontal diameter is an antero-posterior one; namely, from a point on about the center of the curved back to the anterior plane formed by the legs, arms, and umbilical cord. In other words, as frozen sections prove, the fetal ellipse is flattened laterally (Fig. 545). This is true for all presentations with the possible exception of the shoulder. From this it will be readily seen that accommodation or adaptation will cause the largest transverse diameter of the fetal ellipse to correspond to the roomiest horizontal diameter of the uterus. Hence the antero-posterior diameter of the fetal ellipse must correspond to the transverse diameter of the uterus, and torsion of the uterus causes this latter to coincide practically with the right oblique of the pelvic inlet. The presence of the two parts of the bowel, the sigmoid flexure and the rectum, through which the feces so often pass, is sufficient to account for the oblique position of the presenting part, whether the back lies anterior or posterior, and so to explain the usual positions—left anterior or right posterior.

Although the transverse diameter of the bony inlet is by actual measurement the longest, still this long diameter passes just in front of the promontory of the sacrum, and the head enters the plane of the inlet half-way between the symphysis and sacrum, and here the diameter is less than $5\frac{1}{4}$ inches (Fig. 514). These facts account for the head lying in one or the other of the oblique diameters. Another factor is also present, and that is the encroachment of the muscles, the ilio-psoas in particular, on the inlet of the pelvis (Fig. 546). This makes the transverse diameter of the superior strait less capacious than the oblique. This, too, then accounts for the predominance of oblique fetal positions regardless of the presentation. It has been determined that these muscles decrease the transverse diameter by about 1.5 cm. (0.5906 inch) and the conjugate by 1 cm. (0.3937 inch). The most frequent positions of the fetus therefore are the first and third, the former being most frequent for reasons stated above.

We may sum up the causes of the greater frequency of the first and third positions as follows: (1) The flattened shape of the fetal ovoid; (2) the shape of the uterine cavity; (3) the axial torsion of the uterus; (4) the shortening of the left oblique diameter of the pelvis by the sigmoid and rectum; (5) the diminution of the transverse diameter of the pelvis by muscles and sacral promontory; (6) the greater roominess of the right oblique diameter.

*Various causes for this axial rotation have been suggested: (1) the position of the descending colon and the sigmoid flexure, which are often distended with fecal matter; (2) the embryological development of the uterus; (3) the fact that the right round ligament is shorter and more highly developed than its fellow; (4) the greater frequency of the right lateral position of the patient.

III. THE EXPELLING FORCES.

The expelling forces consist, first, of the voluntary or auxiliary forces, which include the anterior and lateral abdominal muscles, diaphragm, and pelvic floor; and, second, of the involuntary forces, which consist of the contractions of the uterus and of the round and broad ligaments.

1. The Voluntary or Auxiliary Forces.—(1) *Abdominal Muscles and Diaphragm.*—The abdominal muscles and diaphragm in contracting increase the intra-abdominal pressure and give efficient assistance to the efforts of the uterus. These forces come into play with the second stage of labor, and are at first almost purely voluntary, but later on, toward the end of the second stage, they are reflex by nature.* This increased abdominal pressure tends to force the uterus with its contents downward, in a line whose direction is that of the axis of the pelvic inlet. *Action:* Their action is as follows: In the process of labor the patient draws a deep inspiration, thus flattening the diaphragm; the glottis is closed and the diaphragm becomes fixed and contraction of the abdominal muscles takes place. As a result of the descent of the diaphragm the fundus is pressed forward so that the uterine axis is practically in line with that of the pelvic inlet. In the last part of the expulsive period, when the pains continue for several seconds, the patient is forced to open the glottis for breath; the abdominal pressure is by this action relieved until closure of the glottis once more takes place. At times, when the pain becomes unendurable and the patient is forced to cry out, the glottis is again opened, so it may happen that in the course of one uterine pain there are several abdominal contractions. Harvey, experimenting on dogs, and de Graaf on rabbits, in order to show that the fetus is expelled by the "*vis uteri propria*," opened the abdomen at term; nevertheless the animals expelled their young without, of course, the aid of the abdominal muscles. Haller has seen spontaneous expulsion of young in the case of pregnant females a short time after death. (See Post-mortem Delivery.) Harvey, Smellie, and others have reported cases of spontaneous labor in paraplegic women. Although the voluntary and reflex contractions of the abdominal muscles are not an indispensable factor in labor, nevertheless they accelerate the expulsion. It is undoubtedly true that the application of forceps is often necessary on account of the feebleness of the effort which is expended—for instance, in women with hernia.

I have repeatedly observed and demonstrated to students the second stage of labor terminated without the co-operation of the abdominal muscles at all; still, the action of these muscles is most important in the expulsion of the placenta, especially after it has left the uterus. It can be clearly seen of what assistance also the abdominal contractions are in completing the birth of the child in breech cases, when the after-coming head has passed below the retracted fundus.

(2) *The Vagina and Pelvic Muscles.*—At term the musculature of the vagina is hypertrophied to a considerable extent and is important in the expulsion of parts of the ovum that can be acted on by peristalsis. The period when its action is most valuable is during the expulsion of the placenta. The only pelvic muscles of the pelvic floor concerned in expulsion are the levator ani, the transversi, the sphincters of the vagina and of the anus. Their action is imperfectly peristaltic and assists the muscle of the vagina.

2. The Involuntary Forces, or Uterine Contractions.—The uterus, during the

* It was at one time held that the abdominal wall was the sole cause of the birth of the child; later it was taught that it played no part, but Schroeder showed that both uterine and abdominal contractions were concerned in the expulsion of the fetus.

contractions of the second stage, is retained in its position by means of the round ligaments, which are composed chiefly of involuntary muscle-fibers, assisted by the muscular part of the broad ligaments. In contracting, the round ligaments tend to force the fundus downward and forward, and by their action on the upper part of the uterus they are one factor in the increase of intrauterine pressure. After the uterus has been raised by the round ligaments, however, abdominal pressure can act to better advantage.

(1) *Involuntary.* — Although the uterine contractions have no dependence on the will,—*i. e.*, they are involuntary,—they may be considerably influenced by the brain, as may be seen by the effect of mental emotions.

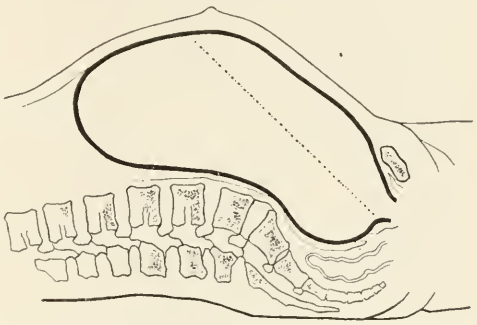

FIG. 553.—SHAPE OF THE UTERUS DURING THE PERIOD OF RELAXATION.

(2) *Peristaltic.*—Like other organs composed of non-striated muscle, the contractions are assumed to be peristaltic in nature, probably passing from the Fallopian tubes down to the cervix. The waves succeed each other so quickly that the whole uterus is in action at the same time. From observations on the lower animals it is believed that the direction is from above downward, and the uteri of rabbits, for example, being of a long, tubal form, act just like a length of intestine. It is the general belief that the contraction of the human uterus is not peristaltic. I have repeatedly attempted to determine this point in Cæsarean section cases, but the contractile segment was so instantaneously involved that no peristaltic wave could be demonstrated.

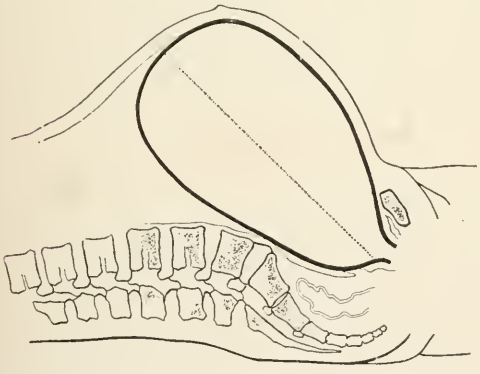

FIG. 554.—SHAPE OF THE UTERUS DURING A UTERINE CONTRACTION.

(3) *Intermittent.* — The contractions are intermittent; each contraction begins, reaches its acme, and then subsides, the length of time occupied by one "pain" depending upon the stage of labor in which it occurs, the average duration being about a minute; the variations being between thirty and sixty seconds. The interval between contractions is about thirty minutes at first, but decreases to between two and three minutes at the end of labor. The contractions are rhythmical in their intermission—there is an approximate regularity about them. In this respect there is a variation in the same ratio as the length of the single pains. During labor the contractions gradually increase in severity, duration, and frequency. At the beginning of labor the duration of the contractions is about twenty seconds. Toward the end of the second stage the duration is a minute or more. In some cases, after the uterine contractions have continued for some hours, they cease for a corresponding period, after which they once more become vigorous.

(4) The normal intermittence in the course of the contractions is a most

necessary feature for the welfare of both mother and fetus. The latter would succumb to asphyxiation were the contractions continuous, and the mother would not be able to endure the long agony were it not alleviated by periods of rest. She would also be subject to much injury of her tissues, and rupture of the uterus would almost surely occur. The musculature of the uterus also would not receive its nourishment and it would lose its irritability. This alteration of work and rest in the uterus has its analogue in the action of many other organs,—*e. g.*, the heart, intestines, and brain,—these conditions seeming to be one of the essential characteristics of living organs.

(5) *The Uterus Changes in Form and Position.*—Changes in form and position of the uterus are also associated with its contractions. Its shape becomes cylindrical during a contraction; the longitudinal and the antero-posterior diameters are increased to a slight degree, while the transverse is distinctly decreased. This latter, shortening somewhat, extends the fetus; its curvature is lessened and thus causes an increase in the longitudinal diameter, causing partial extension of the fetal ellipse. The effect of the contraction of the round and broad ligaments on the uterus has been noted on page 429 (Figs. 553 and 554).

(6) *Proportionate to the Resistance.*—The force of contractions increases with the advancement of labor; the length of the contractions increasing as the length of the interval decreases. The pain caused by contraction against resistance is generally proportionate to the resistance, though not invariably so, for in primiparæ in whom there is great resistance this state is usually counterbalanced by the superior quality of the uterine musculature. The opposite conditions are present in multiparæ. In the second or third labor conditions bear a more favorable relation to each other than at any other time.

(7) *Vary with the Presentation.*—The character of the contraction varies with the presentation. In vertex presentations the contractions possess more regularity and efficiency, and may even be termed characteristic of normal labor; in face, brow, breech, and shoulder presentations irregularities are usually manifest, so that the physiognomy of labor is well worth a careful study. For in order to obtain normal characteristics there must be uniform pressure on the lower uterine segment and the os, and this is not exerted in breech, face, brow, or shoulder presentations; hence the facies in labor will often give the keynote to the presentation.

(8) *The Pain of Uterine Contractions.*—The contractions are painful, this being their most striking characteristic. It has given rise to the term "labor pain." It is a well-known fact that in the majority of cases the first pain occurs between ten and twelve o'clock at night. The cause is not known. As to the character of the pains, it differs with the stage of labor in which the pain occurs. They are at first quick, sharp, and colicky, and are due chiefly to the dilatation of the cervix, and are felt usually in the sacral region, where pain originating in the cervix is almost invariably referred. After the os has been dilated they become "bearing down" in quality, and are then efficient in expelling the fetus. As to the intensity of the pains, that will depend on the nervous constitution of the patient. They are generally more severe in primiparæ, especially during the stretching of the vagina and vulva. Pain is also caused by resistance of the brim, and by the strain to which the attachments of the uterus are subjected. To this is added the pressure by the heavy uterus on the nerve plexuses in the pelvis, and that on the nerves of the vagina by the presenting part. The abdominal muscles also are the seat of pain on account of their contractions, which are cramp-like. Pain is also probably caused

by compression of the ends of the nerves which lie between the contracting fibers. Werth advances the suggestion that another cause is spinal neuralgia resulting from the anemic condition of the lower cord and meninges.

(9) *False Contractions or Pains.*—These are contractions, sometimes painless, at others very painful, which are generally localized in the abdomen, and as a rule take place in multiparæ. They occur a short time before labor begins and generally in the early hours of the night. They have no effect in causing dilatation nor are they accompanied by the "show."

(10) *Pulse and Arterial Tension.*—There is an increase in pulse-rate during a uterine contraction, but it gradually decreases at the close. Arterial tension is increased on account of the amount of blood that is driven from the uterus to the general circulation. Respiration grows less frequent during a pain, but increases in the intervals. The temperature of both uterus and body is a little increased during a contraction.

Strength of Uterine Contractions.—Schatz * found that the pressure on the dynamometer was 20 mm. mercury, while 15 mm. of this are due to the weight of the fluid. At the height of the contraction it ranged to 100 mm. Considerable resistance has to be overcome by the uterine contractions. If we measure the amount of force necessary to rupture the membranes outside the body, we will have an approximate estimate of the force of the contractions. Matthews Duncan's work was carried on with a piece of membrane about 4, inches in diameter placed over a cylinder connected with an anemometer. His results varied from 5 to 37 pounds (2100 to 17,000 grams). In some cases a force equal to the mere weight of the fetus accomplished the rupture; in others considerable force was required. *Polaillon's method:* In this the surface of the membranes was estimated as 217 square inches (1400 sq. cm.). Pressure exerted by the uterus amounts to 338.8 pounds (154 kilos), 88 of which are due to uterine contractions and the rest to the weight of the fetus. Another method gave him the force of each pain as 19.8 pounds (9 kilos), and for the whole labor 965.8 pounds (439 kilos). Duncan estimated that the force in a whole labor was 40 or 50 pounds (18 to 22 kilos), and the effort which must be made to hold back the head gives these figures. He also estimated the amount of force which a child can endure, and found that there was no change till 90 or 100 pounds was reached. After this the cervical vertebræ are dislocated and 30 pounds (about 14 kilos) more will sever the head. Hence the force in labor must be less than this figure. In his estimations Poullet made use of the tocograph, and Dr. Henry Leaman, of Philadelphia, invented an instrument which he called the parturiometer, for measuring the force of uterine contractions. This last instrument I experimented with for two years, but was never able to arrive at any satisfactory conclusions.

IV. THE ETIOLOGY OF LABOR.

There is a fatty degeneration on the surface of the placenta which supervenes near the end of gestation in many cases, but this is not constant. Eventually the ovum becomes a foreign body. This theory was advanced by Naegele and others, and the view appears to be a rational one. Eden regards all the changes in the placenta as senile which finally cause it to become a foreign body. Leopold found marked thrombosis of the vessels in the decidua. He considered that this finally causes an increase in carbonic acid which soon causes contractions. Some believe that when the uterine musculature is completely developed labor begins, but we see uterine contractions in abortion and premature labor. Still another view is that after the uterus has been distended to a certain extent there comes a reaction, and the process of retraction begins and the fetus is expelled. But this does not clear up the matter, since the thickness of the uterus varies in different subjects and in the same subject in different pregnancies. Then, too, the uterus is distended by hydramnios and multiple pregnancies far more than in normal

* The instrument used by Schatz was called the tocodynamometer.

pregnancy, and still the general rule holds good that the fetus is born when it becomes mature—not before, not afterward. Spiegelberg advances the explanation that certain substances in the maternal blood which in the early part of pregnancy the fetus has made use of, accumulate, since the nearer the fetus comes to maturity, the less use it has for these same substances. As it reaches the point of maturity and needs other forms of nutrition which it is now unable to obtain, this fact, as well as the accumulated material in the mother's blood which acts upon the motor centers of the uterus, militates for its speedy expulsion. Since Braxton Hicks published his observations on the constant contractions of the uterus, these various theories have been less convincing. He claimed that the contractions take place after the uterus appears above the symphysis pubis, and during labor these contractions are accentuated. The function of these contractions in pregnancy is not known, but at the end of pregnancy they expel the fetus from the uterus. Pohlman held that as long as the fetus was immature and attached to the uterus it forms a part of the maternal organism, at least in effect; but when full maturity is attained it becomes a foreign body and is expressed by uterine contractions. The causation of labor is a very complicated question, and we are to-day ignorant of the actual determining factor, through the operation of which a uterus, after remaining comparatively quiescent for thirty odd weeks, suddenly and perhaps unexpectedly takes it upon itself to get rid of a burden it has carried so long without rebellion.

It is probable that there are several predisposing causes, and that the real direct or exciting cause is some slight circulatory or nervous disturbance brought on by overexertion, an overdose of cathartic, a misstep, straining at stool or micturition, or mental excitement.

V. THE STAGES OF LABOR.

It is customary to divide labor into three periods or stages: namely, first, second, and third, and designated respectively, stage of dilatation, of expulsion, and last of placental delivery and uterine contraction and retraction. To these we add, without assigning it a number, another; namely, the preparatory stage.

The preparatory stage of labor extends from subsidence or sinking of the uterus until true labor sets in, and begins about two weeks before true labor in primigravidæ and ten days before in multigravidæ. Its phenomena consist in (1) sinking of the uterus, the so-called "lightening"; (2) gradual shortening of the cervix and dilatation of the internal os, and (3) false or spurious labor pains.

1. In the *sinking of the uterus* the organ sinks lower in the pelvis, the fundus drops forward, and the head either engages or sinks down to the pelvic floor. Deep engagement of the head is more marked and more constant in primigravidæ by reason of the tense abdominal muscles, strong uterine muscles, and greater intraabdominal pressure. In both primigravidæ and multigravidæ we often observe the head distending and pushing down into the pelvis the thinned anterior wall of the lower segment, with resulting posterior displacement of the cervix, so that the os looks backward and upward. This is the so-called sacciform dilatation of the anterior part of the lower uterine segment

(Fig. 790). This change affords great relief to the woman; her respiration is less embarrassed, her clothes are looser, and her digestion is improved. The irritability of the bladder and rectum becomes more marked; mucus pours from the vaginal and cervical glands and is generally a very good indication of the progress of the dilatation of the cervix.

2. The *gradual shortening of the cervix and dilatation of the internal os.* The cervix, as a rule, retains its entirety until the thirty-sixth or thirty-eighth week of gestation; up to this time the cervical canal is one inch long, the external and the internal openings are closed, the supra-vaginal and infra-vaginal portions are present very much as in the non-pregnant state. The greater intra-uterine pressure and distention of the lower uterine segment in primigravidæ causes a gradual expansion and unfolding of the supra-vaginal cervix at about the thirty-sixth week; but in multigravidæ, because of the previous distention of the lower uterine segment, pressure is not so readily communicated to the margin of the internal os, and dilatation here does not commence until about the thirty-eighth or thirty-ninth week. At the end of gestation in primigravidæ the internal os has usually expanded and disappeared for the reception of the ovum; this is much less often the case in multigravidæ. In pathological instances of overdistention, such as hydramnios and multiple pregnancy, the unfolding and complete disappearance of the internal os is most clearly shown, and is, in some instances, nearly complete. (See the Parturient Canal, page 400.)

3. The *false or spurious labor pains* are the normal intermittent uterine contractions of gestation occurring more frequently than usual, with greater intensity and accompanied by pain. They are often caused by a temporary indigestion or rectal distention, and hence are often relieved by a laxative or enema. They are distinguished from true uterine pains by their temporary character, irregularity, being felt generally over the abdomen instead of in the lumbo-sacral region or just above the pubes; by not progressing in frequency and severity and in not causing any hardening or dilatation of the os. The most definite symptom of the commencement of labor is the presence of uterine contractions or pains, recurring at intervals which gradually decrease in length, while the force of the contractions increases, and causing a gradual thinning and dilatation of the cervix.

1. **The first stage of labor, or stage of dilatation,** extends from the onset of true labor pains to the complete dilatation or dilatability of the os. The duration of this stage is variable; it may be as short as two hours or it may continue several days. The length is influenced by the age of the patient and by the number of children she has borne, it being longest in elderly women, especially primiparæ. The average duration for primiparæ is often stated to be sixteen hours, though it may be much longer; while for multiparæ an average of nine hours may be quoted. The phenomena of this stage are (1) true uterine contractions or labor pains; (2) a muco-sanguineous discharge; (3) the mechanism of cervical dilatation; (4) the formation of the caput succedaneum.

1. The *true labor pains* cause the patient to assume different attitudes; she is restless, often walking about from place to place and emitting cries on the occurrence of a "pain," very different in character from those of the later stages. The contractions or "pains," which at first are not very annoying, occur about every half hour, and are accompanied generally by pressure sensations. At first the pain is apt to be felt in the region of the sacrum, which is the common location for pain originating from any cervical trouble, and it may radiate to the lower abdomen or down the legs. Generally the first pains come on in the early part of the night, and in character they closely re-

semble the false pains which are often felt in the last weeks of pregnancy. The woman is frequently more impatient of the pains of dilatation than she is of the later ones, because she fails to see that any progress is being made, although the passage of the head over the exquisitely sensitive perineum causes the most excruciating agony experienced during all the course of labor. The patient often vomits or shivers at this stage; there is an abundant secretion of urine; the cervix grows gradually more patulous till its edges become con-

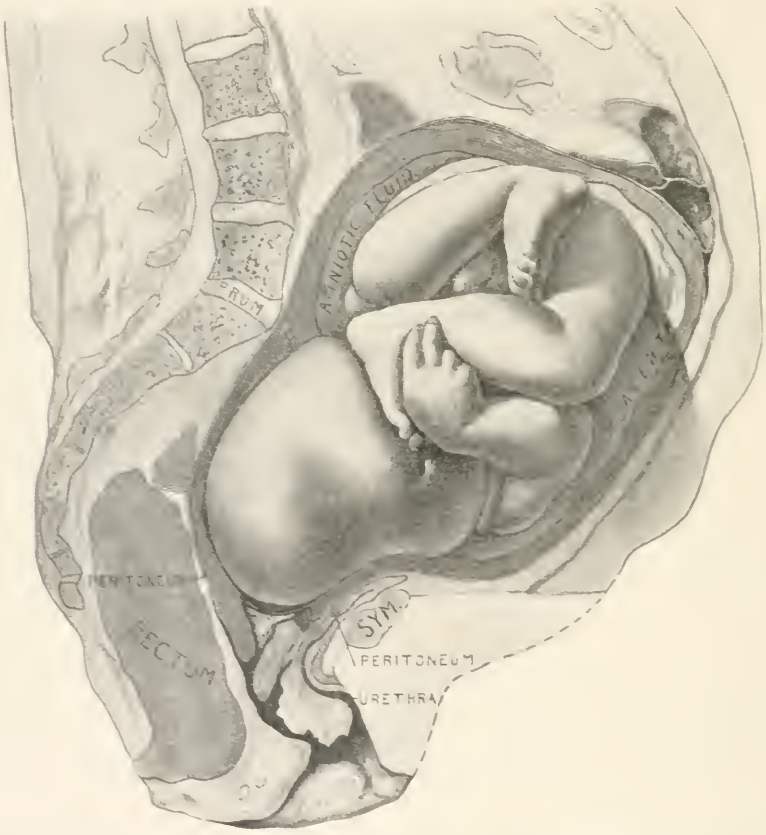

FIG. 555.—FROZEN SECTION AFTER SUDDEN DEATH FROM CEREBRAL ABSCESS, DURING THE FIRST STAGE OF LABOR. Age of patient thirty-seven years; 7-para; fundus uteri 3 inches above the umbilicus; internal os dilated to admit two fingers. The section is a vertical mesial one with the frozen fetal parts of the opposite side placed in exact superposition. Note the posture of the fetus and moulding of the head, the latter being well above the pelvic floor; also the lower borders of the peritoneum anteriorly and posteriorly; the beginning formation of the "bag of waters," and the contraction ring; and the distended rectum.—(*William C. Lusk's case.*)

tinuous with the walls of the vagina. When the diameter of the opening reaches about three inches, the descending "bag of waters" ruptures, allowing a little of the liquid to escape, while the remainder is kept back by the ball valve-like action of the head. The temperature rises slightly and the pulse of the patient increases during a uterine contraction, but the fetal heart-beat is slowed at the height of a pain.

2. The *muco-sanguineous discharge*. All of the secretions, both vaginal

and cervical, are increased with the progress of labor, and they serve as a lubricant to the passages. As the lower uterine segment and the cervix expand the lower part of the membranes is separated from the wall of the uterus, giving rise to a slight hemorrhage which streaks the mucous discharge, and early in labor the bloody mucus is known as the "show."

3. The *mechanism of cervical dilatation* (Figs. 556 to 564). According to well-known hydrostatic laws, the pressure of the uterine walls in the state of contraction is communicated to the fluid in the bag of waters in a generally uniform manner, barring the variations which occur at different levels, and which are due to the weight of the liquid (Fig. 565). There is no propulsion till the cervix begins to be dilated, and then the bag of waters is forced, to a certain degree, out of the os, the fetus in itself not being acted upon, but the force is expended on the entire ovum (Fig. 566). The direction of the force is in the central axis of the os and in a line perpendicular to its plane. The uterus acts in two ways: (1) when it contracts its internal area is diminished, and the result is intrauterine fluid pressure caused by the force exerted on the fluid within the ovum; (2) after rupture of the membranes, and the consequent escape of fluid, there occurs direct contact between the fundus and the breech, and, indeed, this may very occasionally occur before the membranes are ruptured. The abdominal muscles assist the uterus in both these forms of action; they add their part to the force exerted by the uterus before the membranes are ruptured as well as after this event takes place. The os may be said to be dilated normally by the protruding bag of waters; this being the case when the fluid is abundant and the membranes are unruptured. When these conditions are present, the intrauterine fluid pressure has no effect on the fetus; this can be inferred from the law in hydrostatics that fluid pressures, whatever the cause, are always equal and opposite in all directions; hence the fetus is not affected by contractions of the uterine musculature. Although the lower uterine segment makes an effort at contraction, it is forced open at the os by the power of the upper strong part. It is well known that the lower uterine segment is by far the weakest part of the uterus, and so, during contraction, its tendency is to expand; this being the effect of the intrauterine fluid pressure. That part of the area of the uterus which is opposite the vagina is not supported by the intra-abdominal pressure nor by the abdominal muscles, both of which factors hold sway above. In this way not only is the centrifugal force increased, but the centripetal force is diminished. Another feature which adds to the weakness of this part of the organ is the os—an opening in the uterine wall much weaker than the Fallopian tube openings. So that, indeed, the very first effect of uterine contractions is seen in the expansion of the lower uterine segment. While the internal os and upper cervix and supravaginal portion are dilating, the bag of waters begins to bulge through the os, and the fluid pressure can then act directly on its edges. This process gradually proceeds till the internal os disappears, the cervix shortens till it also is abolished, and then the membranes act directly on the external os. The force exerted by the membranes is directly proportional to their convexity. This can be explained by the law in physics that the fluid pressure is opposite and equal in all points, and is exerted at right angles to any surface against which it acts. Consequently the rapidity of dilatation will correspond with the degree of bulging of the membranes through the os. After the membranes are ruptured these laws are applicable to the force exerted by the head in causing dilatation. These facts, together with that of the successively increasing force of uterine contractions,

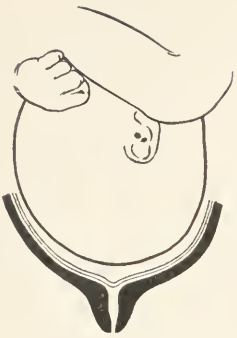

FIG. 556. — PRIMIPAROUS CERVIX AT THE BEGINNING OF UTERINE CONTRACTIONS.

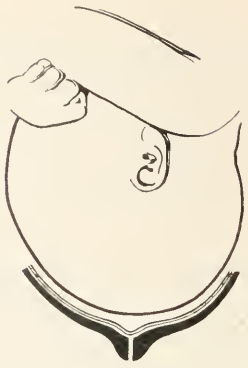

FIG. 557. — PRIMIPAROUS CERVIX EARLY IN LABOR.

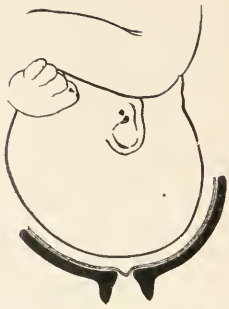

FIG. 558.—CERVIX IN MULTIPARA AT BEGINNING OF UTERINE CONTRACTIONS.

FIG. 559. — MULTIPAROUS CERVIX EARLY IN LABOR.

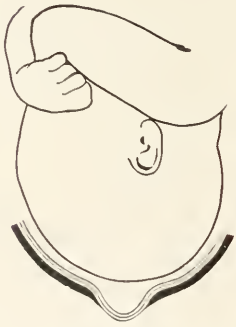

FIG. 560. — PRIMIPAROUS AND MULTIPAROUS CERVIX. DILATATION FOR TWO OR THREE FINGERS.

FIG. 561.—"FALSE WATERS." FLUID BETWEEN CHORION AND UTERINE WALL ABOVE AND BETWEEN CHORION AND AMNION BELOW.

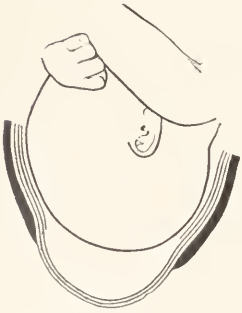

FIG. 562.—PRIMIPAROUS OR MULTIPAROUS CERVIX. OS ONE-HALF DILATED. INTERNAL OS DRAWN UP INTO LOWER UTERINE SEGMENT.

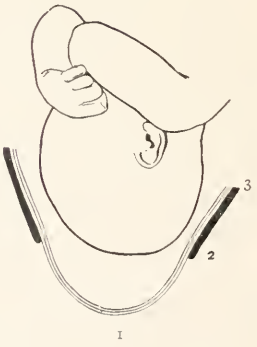

FIG. 563. — RUPTURE OF THE MEMBRANES. 1, Usual site; 2, just inside the os; 3, within the uterus.

FIG. 564.—FORMATION OF A SECOND BAG OF WATERS.

explain why the last stages of dilatation are nearly always more rapid than the first. To refer back to what was called the normal mechanism of the first stage,—the membranes being unruptured,—the progress of the first stage of labor is chiefly due to the first form of uterine force, the intrauterine fluid pressure, while the membranes act only as dilators. The second form has not yet been called into play,—direct pressure of the walls on the child,—neither is the voluntary action of the abdominal muscles often present, so the intrauterine fluid pressure due to the general intra-abdominal pressure always exerted by the tonicity of these muscles is to be looked upon as the important factor in causing the progress of labor at this stage.

4. *Caput succedaneum.* If this stage is prolonged, a scalp tumor forms

FIG. 565.—GENERAL INTRAUTERINE PRESSURE DURING A UTERINE CONTRACTION, BEFORE RUPTURE OF THE MEMBRANES. The × and — signs indicate the results of general intrauterine pressure.

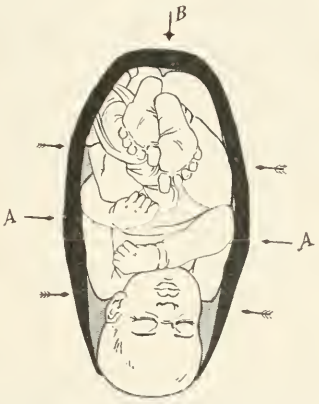

FIG. 566.—FURTHER RESULT OF GENERAL INTRAUTERINE PRESSURE. The lower segment is weakened, thinned, and dilated. *A*, *A*, and *B* indicate the directions of the remaining pressures.

FIG. 567.—STILL FURTHER RESULT OF THE GENERAL INTRAUTERINE PRESSURE. The fetus is partially expelled from the cervix, and the uterus in consequence shortens and becomes thicker in its upper part. *A*, *A*, Lateral uterine pressure; *B*, direct pressure of the thickened fundus upon the fetal axis.

on that portion of the head least subjected to pressure, due to venous congestion and œdema. (Compare Part IX.)

2. The second stage of labor, or stage of expulsion, extends from the complete dilatation or dilatability of the os to the complete expulsion of the fetus. The duration of this stage varies from a few minutes to six hours or more. Its average duration in primiparæ is from two to three hours, and in multiparæ from one to two hours. The phenomena of this stage consist in: (1) Characteristic uterine contractions; (2) the use of voluntary forces; (3) the descent of the presenting part; (4) the dilatation of the vagina; (5) the dilatation of the vulva; (6) the expulsion of the fetus.

1 and 2. *Uterine contractions and the use of voluntary forces.* The nature of the contractions is entirely changed; they are far more severe than in the first stage, and are bearing-down in character; the voluntary forces are now utilized;

the patient makes use of the diaphragm and the abdominal muscles; she braces herself for every paroxysm and holds tightly to whatever support may be at hand. The cry differs also from the earlier one, the patient often taking a quick inspiration in the midst of a pain in order to be able to resume the expulsive effort, this being accompanied by a characteristic grunt or the whole ended by a moan. The pains are now efficient, and as the fetus is driven out through the dilated cervix the vagina relaxes to receive it. When the perineum is reached,

FIG. 568.—CENTRAL SEPARATION OF THE PLACENTA FROM THE UTERINE WALL, WITH THE FORMATION OF A RETROPLACENTAL BLOOD-MASS. (Schultze's mechanism.)

FIG. 569.—DESCENT OF THE PLACENTA DOUBLED UPON ITSELF, WITH THE CENTER OF THE FETAL SURFACE PRESENTING. (Schultze's mechanism.)

FIG. 570.—DESCENT OF THE PLACENTA WITH THE LOWER BORDER FIRST, THROUGH THE CERVIX AND VAGINA. (Duncan's mechanism.)

FIG. 571.—COMPLETE SEPARATION OF THE PLACENTA. The placenta is expelled flat with the lower margin first presenting. (Duncan's mechanism.)

its firm but elastic structures bulge with every uterine contraction and recede with its subsidence. The pelvic floor directs the presenting part upward and forward toward the orifice of the vulva. Mucus lubricates both the passages and fetus, and thus the vagina more easily allows the onward movement of the fetus. Between the pains the soft parts press back the fetus till the presenting part is so firmly fastened under the symphysis pubis that this cannot recur. Finally the vulva gapes; the presenting part is seen; the anus relaxes and the

rectal wall appears; there is an uncontrollable desire to micturate and defecate, due to pressure on bladder and rectum; there comes the crowning effort, and the head passes through the external opening (Fig. 590). The fundus uteri now quickly subsides and the uterine muscle is in close contact with the parts of the fetus still contained within it. At this stage there generally occurs a slight pause, varying in duration. There is sometimes a cry at the expulsion of the head and sometimes the patient makes no sound; when present, this has been known as the physiological cry.

3. The third stage of labor, or stage of placental delivery and uterine contraction and retraction, extends from complete expulsion of the fetus to complete expulsion of the placenta and membranes. The average duration of this stage is, when spontaneously completed, about one hour. Immediately after birth the patient feels calm and comfortable. Now and then there is a feeling of faintness caused by the sudden evacuation of the uterus. The phenomena of the third stage are: (1) characteristic uterine contractions; (2) the control of hemorrhage; (3) the separation of the placenta; (4) the expulsion of the placenta; (5) the physiological chill.

1. *Uterine contractions.* After the completion of the second stage the uterus may be palpated in the hypogastrium, and should resemble a firm, round, ball-shaped body, and more or less tonic as well as rhythmic contractions should be present, although the latter are not necessarily felt by the woman as "pains." The hardness of the uterus varies at this time and after the expulsion of the placenta, but the risk of hemorrhage is not necessarily great unless there is much relaxation between the intermittent contractions, or sudden gushes of blood occur during or between the contractions.

2. The *control of hemorrhage* at this time is primarily due to the constriction of the vessels by the firm and tonic uterine contractions, and secondarily to coagulation of the blood in the mouths of the vessels.

3. *Placental detachment.* At or just before the expulsion of the fetus, the placenta is partially detached from the uterus. Shrinkage of the placental site and the forcing downward of the whole placental mass by uterine contractions account for this separation. The usual and I believe normal manner of placental delivery is for it to be folded on itself by the contracting uterus, so that the long axis of the placenta corresponds to the long axis of the uterus, and the margin that presents at the cervix, vagina, and vulva is the lower margin, showing perhaps a little of its fetal surface (Duncan's method) (Figs. 570, 571). Occasionally, especially when traction has been made upon the cord, the center of the fetal surface with the attached cord presents first, like an inverted umbrella (Schultze's method) (Figs. 568, 569). It makes very little difference, from a practical standpoint, how the placenta is born.

4. *Placental expulsion* occasionally occurs with or just after the birth of the fetus; usually, however, in purely spontaneous placental delivery, an hour or even more intervenes between the fetal and the placental delivery. During this time the uterus should be moderately hard as the result of tonic contraction, and intermittent or rhythmic contractions, though not strongly marked, should be present, thus causing the uterus to vary in hardness. The intermittent contractions after a short time become stronger, nearer together, and finally are felt as "pains" by the patient, and a little blood is expelled by them from the vagina. In spontaneous expulsion these contractions finally complete placental separation and force the placenta down so that it lies partly in the flaccid, relaxed cervix and partly in the vagina. In the absence of interference its expulsion from the vulva is accomplished by the voluntary forces, aided by the contractions of the uterus and vagina.

5. *Physiological chill.* Not uncommonly some slight shivering, in some cases, —about 15 per cent.,—even passing into a decided chill, takes place shortly after the placental delivery. It is more often observed after rapid deliveries, and may continue from a few minutes to a quarter of an hour, and is unattended by any alterations in the pulse or temperature. Its best explanation is that the organism, or rather the abdomen, loses a large mass to which it had been previously accustomed, the result being that the internal viscera are no longer compressed, and we have a rapid rush of blood from the exterior to fill the space left in these organs. Consequently a more or less severe chill results, which is entirely physiological and is not a signal of danger.

VI. THE MECHANISM OF LABOR.

Definition.—The mechanism of labor is the manner in which the fetus passes through the parturient canal; and it has to deal with the hard and the soft parts which compose the latter and with the fetus and the expelling forces. It treats of the movements of the fetus through and out of the parturient canal, and the causation and character of these movements.

Importance.—Familiarity with the three factors of labor—namely, the passages, the passenger, and the forces—is essential in order to appreciate the combination of movements known as the mechanism of labor by which nature guides the fetus from the uterine cavity through the pelvis into the external world. With equal success might we hope to appreciate and treat certain cardiac diseases without an understanding of the anatomy and physiology of the heart, as to attempt the management of labor cases without a clear knowledge of the mechanism of parturition. It is true that one ignorant of the mechanism of labor may successfully care for cases of normal confinement; it is equally true, in other instances, that this want of knowledge results in disaster to mother and fetus.

But one mechanism of labor. From a mechanical standpoint all labors are subject to the same physical laws and follow these laws, provided only that expulsion occurs, spontaneously and at term, of a normal-sized fetus, and through a normal pelvis; in premature labors and in cases of monstrosities and deformed pelves many departures from the usual mechanism occur. It may be stated, then, that there is but one mechanism of labor for all. The mechanism of the first vertex position (L. O. A.) may be looked upon as the standard; and the mechanism of the other three positions of the vertex, and the several positions of the breech, face, and brow, as following the same general standard.

Six Stages.—Six clearly defined stages of mechanism in all presentations and positions, with the exception of shoulder presentation, can usually be demonstrated. These stages are: (1) Moulding; (2) engagement and descent; (3) rotation of the first part of the fetal ellipse; (4) expulsion of the first part of the fetal ellipse; (5) rotation of the second part of the fetal ellipse; (6) expulsion of the second part of the fetal ellipse.

I. Moulding.—In the first stage the fetus, pressed upon and influenced by the general intrauterine pressure, and perhaps also to a slight extent by the voluntary efforts of the mother, tends to accommodate, to mould the shape of its presenting part to suit the canal through which it has to pass. This moulding in vertex presentation is accomplished by overriding of the bones

of the vault of the skull and by actual change of the shape of the brain; in brow presentations the same causes operate; in face presentations, the bones of the face proper change very little, although a characteristic moulding of the frontal, parietal, and occipital bones occurs, and swelling and œdema of the facial tissue assists in the acquired general shape of the head; in breech presentation moulding is entirely due to compression of the soft tissues.

II. Engagement and Descent.—Engagement of the head in the pelvis in vertex presentations, especially in primigravidæ, often occurs before labor sets in. En-

FIG. 572.—THE MECHANISM OF LABOR. THE HEAD IN THE LEFT OCCIPITO-ANTERIOR POSITION ON THE PELVIC FLOOR BEFORE ANTERIOR ROTATION AND DILATATION OF THE VULVAL ORIFICE.

gagement and descent occur more readily and promptly in anterior positions of the vertex and with moderate-sized fetuses. Delayed engagement and descent we observe in posterior positions of the vertex; in primary or secondary inertia of the uterus; in excessive uterine obliquity and torsion; in brow presentations, since a greater circumference presents; in face and breech presentations because these parts are irregular, are poor dilators, and are subject to œdematous swelling. Naturally engagement and descent in any presentation or position are favored by undersized fetuses and roomy pelvic inlets.

III. Rotation of the First Part of the Fetal Ellipse.—All explanations of in-

ternal rotation apart from the fetus may be classed as (1) uterine and (2) pelvic. The uterine theory attributes a rotation force to the uterus itself. The pelvic explanation takes into account the shape of the pelvis—as determined by the ischial spines and planes and varying lengths of the pelvic diameters—and the shape, resistance, and actions of the structures going to make up the perineal floor. The anatomical investigations of J. Veit * and H. Varnier † deny to the shape of the pelvis—namely, the varying lengths of the various planes—and even to the bones of the pelvic outlet any influence on the internal rotation of the head. The latter explains the rotation of the head as due exclusively to the arrangement of the muscles of the pelvic floor and the perineum.

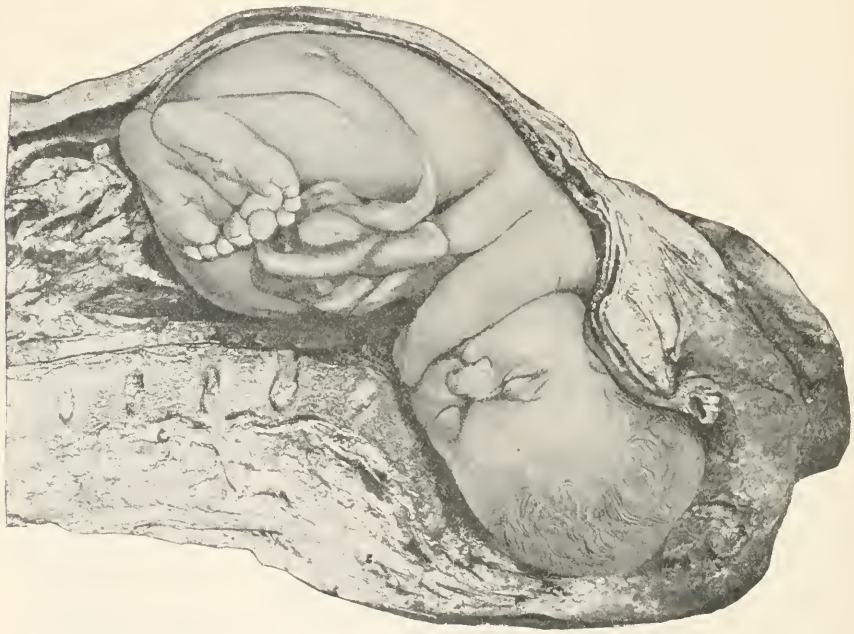

FIG. 573.—THE MECHANISM OF LABOR. THE HEAD IN THE LEFT OCCIPITO-ANTERIOR POSITION ON THE PELVIC FLOOR. A caput succedaneum has formed, anterior rotation has just begun, and partial dilatation of the parturient outlet has taken place.—(*Studdiford's frozen section at the Emergency Hospital.*)

Desiring to test for myself experimentally the part the pelvic floor plays on anterior rotation of the presenting part, I undertook the following experiments: I screwed a swivel into the head of a fetal cadaver half an inch behind the small fontanelle, attaching a yard of cord to the ring of the swivel. I repeatedly dragged the head through the pelvis of a woman dead after recent delivery. The occiput invariably rotated to the front, even when the head entered the pelvis in the posterior positions, so long as the pelvic floor retained its integrity. When the tonicity of the floor became impaired by overstretching, the head traversed the pelvis in very nearly the same position at it had entered.‡ In making use of the term complete rotation of either head or shoulders in these observations, it was not meant that mathematically complete rotation resulted, but only such as palpation or inspection determined, unaided by more exact means of measurement. Leishman's researches with a cord stretched from symphysis to coccyx showed that exact coincidence of the sagittal suture and the antero-posterior diameter of the pelvic outlet failed in many instances. The well-known experiments of Paul Dubois consisted in push-

* "Die Anatomie des Beckens im Hinblick auf den Mech. d. Geb.," 1887.

† "Du Detroit Inférieur musculaire du Basin obstétrical," Paris, 1888.

‡ Edgar: "The Mechanism of Labor," loc. cit.

ing fetal cadavers of various sizes through the birth canal of a puerpera recently dead. He found that the occiput turned forward, provided the pelvic floor was not injured by rupture or overstretching. Repetition of his experiments overstretched the floor, and then rotation failed.

Rotation was complete and readily accomplished in the first of my experiments; then, as the muscles and tissues became more and more stretched and relaxed as the result of repeated pressure upon them, I found rotation first incomplete and finally failing to occur altogether. Given the normal attitude of the fetus (extreme flexion of the head) and good expulsive powers, and the most important remaining condition for forward rotation and a normal mechanism is a firm pelvic floor.

FIG. 574.—THE MECHANISM OF LABOR. THE VERTEX IS DILATING THE PARTURIENT OUTLET AFTER ANTERIOR ROTATION OF THE OCCIPUT—"CROWNING."

A clear mental picture of the shape of the fetal ellipse and of the parturient canal is absolutely essential to the further understanding of the mechanism of parturition. One should always recollect: (1) The fetal ellipse is made up of two parts, a bulkier but more compressible body, and a relatively smaller but less compressible head; these parts are readily movable in their relation to each other so as to produce degrees of flexion and extension and of torsion and rotation (Fig. 544). (2) The antero-posterior diameters of the head are the largest diameters (Fig. 545). (3) While it is true that the greatest diameter of the non-compressed fetal body is the antero-posterior one at the level of the umbilicus, still the greatest diameter of the shoulders is the bisacromial, $4\frac{3}{4}$ inches (12 cm.) (Fig. 547); and at the breech, the bitrochanteric, $3\frac{1}{2}$ inches

(9 cm.) (Fig. 550). (4) The most dependent portion in a vertex presentation is the occiput; in a face presentation, the chin; in a brow presentation, the brow; in a breech presentation, the buttock which lies in the anterior segment of the pelvic cavity; and of two shoulders, the one in the anterior pelvic segment. (5) The greatest resistance of the pelvic floor is found in the posterior segment; the levator ani muscle with other muscles and tissues of the pelvic floor enter into the formation of a scoop-like body with the greatest resistance behind a line joining the spines of the ischii; the tendency and function of which by resistance and contraction are to guide and direct whatever comes in contact

FIG. 575.—THE MECHANISM OF LABOR. EXTENSION OF THE HEAD THROUGH THE PARTURIENT OUTLET.

with it anteriorly toward and into the vulval slit, the weakest and least resistant portion of the pelvic floor. (6) The parturient canal possesses an irregular, corkscrew-like shape. (*a*) The fetal ellipse rests with its greatest (antero-posterior) diameter in the greatest (transverse) diameter of the uterus. Torsion of the uterus swings the left side of the latter forward so that the fetal back points midway between the left and front (Fig. 551). (*b*) The roomiest diameter of the parturient pelvic inlet is the oblique (Fig. 552); into this the presenting part enters. (*c*) The roomiest diameter of the parturient pelvic cavity is still the oblique; through this the presenting part travels. (*d*) The roomiest

diameter of the bony and parturient outlet is the antero-posterior diameter (Fig. 515); this, the long diameter of the presenting part seeks, assisted by the greater resistance of the posterior segment of the pelvic floor and the shape of the entire segment. (7) From the foregoing it follows: (*a*) that the longest horizontal diameter of the uterus is the transverse diameter, rendered oblique in its relation to the pelvic inlet by the torsion of the uterus on its vertical axis; (*b*) the long diameter of the parturient pelvic outlet does not correspond with that of the inlet, hence a torsion, a rota-

FIG. 576.—THE MECHANISM OF LABOR. INTERNAL ROTATION OF THE SHOULDERS AND EXTERNAL ROTATION OF THE HEAD, OR "RESTITUTION." The unsupported head permits the birth of the anterior shoulder first.

tion of the portion of the fetal ellipse passing from one to the other in order to obey the law of physics and travel in the direction of least resistance occurs; (*c*) whatever portion of the presenting portion of the fetal ellipse first strikes the pelvic floor, whether it encounters this structure in front of or behind a median transverse diameter, will be directed forward under the symphysis pubis and into the vulval slit; (*d*) it is undoubtedly the fact that it is not one factor alone, but several, that determine this rotation. Accommodation, adaptation, the great principle that runs through all the mechanism

of labor, whereby the long diameter of the presenting part adapts itself to the long diameter of that part of the pelvis in which it may find itself; the corkscrew-like arrangement of the pelvis; the lessened resistance caused by the urethral and vaginal orifices in front; the greater resistance of the thicker and heavier tissues in the posterior half of the pelvis; the inclination of the pelvis; the shape of the child's head; the inclination of the uterus causing the anterior part of the presenting portion to reach the pelvic floor first—all play their part in the causation of anterior rotation.

Deep Transverse Position.—Not uncommonly in elderly multiparæ with lax soft parts one observes a deep transverse position of the sagittal suture or bitrochanteric diameter; namely, the head or breech advances through the lower part of the pelvis, and even up to the orifice of the vulva, in a transverse or oblique position, and internal rotation occurs only at the very last moment in the vulval orifice. This possibility must ever be kept in mind in medium and low forceps operations upon the head in vertex, face, and brow presentations; for the lateral pelvic walls are $3\frac{1}{2}$ inches (9 cm.) deep, and the distance from shoulders to occiput in vertex presentations, from shoulders to chin in face, and to forehead in brow, does not exceed three inches, and so further descent in transverse positions without rotation and escape of the presenting part would draw the chest into the pelvis with the head, and the dorso-sternal diameter, $3\frac{3}{4}$ inches (12 cm.), added to the presenting head diameter, would result in impaction, and traction with the forceps would greatly endanger the life of the fetus and the soft parts of the mother.

IV. Expulsion of the First Part of the Fetal Ellipse. (See Pathological Labor.)—This is the head in cephalic presentations and the trunk in breech presentations. The manner of expulsion of the head will depend upon the presentation and position. In occipito-anterior positions the head is expelled by a movement of extension in front of the pubis; in permanent occipito-posterior positions, by a movement of extension over the edge of the perineum; in mento-anterior positions of face presentation, the head flexes in front of the pubis; in permanent mento-posterior positions impaction occurs and no expulsion results. In brow presentations the same general mechanism as in occipital presentations obtains. In breech presentations the sacro-perineal curve and the drawing forward of the presenting part by the levator ani muscle cause a lateral flexion of the trunk during its expulsion (compare Fig. 138).

V. Rotation of the Second Part of the Fetal Ellipse.—This occurs (1) in the trunk in cephalic presentations, and (2) in the head in breech presentations.

1. The *internal rotation of the trunk* in cephalic presentations, vertex, face, and brow, naturally causes an external rotation of the expelled head. Internal rotation of the head in breech presentation does not so constantly cause external rotation of the trunk by reason of the greater weight and bulk of the latter. In cephalic presentation—namely, vertex, face, and brow—when the trunk is the second part to be expelled, the shoulders, we have every reason to believe, enter the pelvic inlet in the oblique diameter opposite to the one in which the head entered; or, if the head entered in a transverse diameter, it is possible, in a roomy pelvis and with a child that is not too large, for the shoulders to enter in the opposite diameter or in the antero-posterior diameter of the inlet. At all events, we usually find the shoulders first in an oblique diameter, and the anterior portion of the presenting part, because of the direction of the axis of the superior strait, is lower than is the posterior; consequently it is this part that first reaches, and is influenced by the resistance at, the floor of the pelvis and is deflected anteriorly to the pubic arch. If both shoulders came to the pelvic floor at one

and the same time, we have every reason to believe that they would both be equally influenced by the factors which cause anterior rotation; and consequently the bisacromial diameter would remain in the same diameter in which it entered the pelvic inlet. Observation has taught me that while complete anterior rotation of the head is the rule, yet complete rotation of the shoulders is not by any means so constant as is that of the head. I made observations * upon sixty-seven primiparæ and seventy multiparæ as regards the internal rotation of the bisacromial diameter, and found that complete rotation occurred once in 1.3 cases in primiparæ, and once in 1.2 cases in multiparæ. It will be seen from the above that complete rotation occurs with about equal frequency in primiparæ and multiparæ. Even before the shoulders begin to rotate internally we see an unwinding, as it were, of the muscles of the neck that have been twisted in the internal rotation of the fetal head, and as a consequence the head makes a partial movement of external rotation, and this first partial movement of rotation is termed "restitution." When the shoulders rotate within the pelvis, there must, in consequence, be a decided rotation on the part of the head which is already delivered, and this further and more marked rotation of the head is termed external rotation of the head, whereby in vertex L. O. A. position the face of the child looks almost directly to the inner surface of the right thigh of its mother.

2. *Head rotation in breech cases.* In breech presentations when the head is the second part to be expelled, the long diameter of the head enters the pelvis in the opposite diameter to that in which the bitrochanteric of the breech engaged. Provided the head continues flexed upon the sternum, when the pelvic floor is reached, rotation of the occiput to the pubis and of the face to the hollow of the sacrum occurs, in all but about 1.5 per cent. of cases, no matter what the original direction of the occiput at the inlet. What is the explanation of this rotation? I believe it is to be found at the occipital end of the head, which is the most prominent and consequently the most positively influenced by the pelvic floor. A glance at a cast of a fetus in its normal attitude will demonstrate the prominence of the occiput (Fig. 544). If the forehead were most in evidence, then the opposite rotation would occur.

VI. Expulsion of the Second Part of the Fetal Ellipse.—This is the delivery (1) of the trunk in cephalic presentations, and (2) of the head in breech presentations.

1. First, as to the delivery of the trunk in trunk-last cases, R. Lefour believes the posterior shoulder, as a rule, is born first. Auvard found that in 29 cases the posterior shoulder came first in 16 and the anterior in 9 cases. He recommends in all cases support of the head in order to prevent its own weight interfering with the natural progress of the expulsion of the body. Leonet asserts that the anterior shoulder first disengages in 90 out of 100 cases if the fetal head be not supported; that the posterior shoulder first emerges in 90 out of 100 cases if the head be supported. He states that the danger to the perineum first begins upon the disengagement of the posterior shoulder. Regarding shoulder delivery, I made observations on 69 primiparæ and 68 multiparæ, and found that the posterior shoulder was born three times as often as the anterior in primiparæ and two and a half times as often in multiparæ. In almost every one of the above cases, however, the head upon delivery was lightly supported by the hand; this support results in favoring the birth of the posterior shoulder first. The posture of the woman does not appear to affect the mechanism of shoulder delivery, as my observations upon 15 cases

* "The Mechanism of Labor," loc. cit.

of spontaneous delivery in primiparæ and 28 in multiparæ in dorsal and lateral postures seemed to prove.

2. Head expulsion in head-last cases. (See page 531.)

VII. THE DURATION OF NORMAL LABOR.

The duration of the several stages, as well as the total duration, varies within wide limits in different individuals. Labor is generally one-third shorter in multiparæ than in primiparæ, on account of the soft parts offering less resistance after previous labors. The duration of the spontaneous first stage may be approximately stated as ten to fourteen hours in primiparæ, and six to ten hours in multiparæ; of the second stage, two hours for the former and one hour for the latter. The duration of the third stage varies from a few minutes to two hours; the average being about half an hour. It is rarely spontaneously completed in this country. An obstetric tradition holds that labor is especially prolonged in elderly primiparæ (thirty to forty years). The statistics of Courtade of the Tarnier Clinic (1900) and the author's show that labor in elderly primiparæ is but slightly longer on the average than in primiparæ in general. (See Maternal Dystocia.)

The following table gives the average duration of spontaneous labor in 544 primiparæ and 910 multiparæ, and the average duration in 47 elderly primiparæ from among the lower and laboring classes of New York.

	Average Duration First Stage.	Average Duration Second Stage.	Average Duration Third Stage.	Shortest Total Duration.	Longest Total Duration.	Average Total Duration.
Primiparæ,.	13 hrs. 15 min.	1 hr. 36 min.	38 min.	1 hr. 30 min.	55 hrs. 20 min.	15 hrs. 29 min.
Multiparæ..	9 hrs.	1 hr. 32 min.	32 min.	40 min.	45 hrs. 25 min.	11 hrs. 4 min.
Elderly Primiparæ ..	15 hrs. 52 min.	1 hr. 43 min.	22 min.	2 hrs. 10 min.	53 hrs. 35 min.	15 hrs. 49 min.

Of the primiparæ, the longest duration of the first stage was fifty-four hours; the shortest, forty-five minutes. Of the 544 labors, the second and third stages took place practically together in two cases. Of the multiparæ, the longest duration of the first stage was forty-four hours; the shortest, thirty minutes. The second and third stages took place practically together in three cases. Of the elderly primiparæ, the longest duration of the first stage was fifty-three hours twenty minutes; the shortest, fifty minutes. The longest total duration of labor was fifty-three hours thirty-five minutes; the shortest, two hours ten minutes. Of the 47 cases, in no instance did the placenta follow immediately the birth of the child (see Maternal Dystocia).

VIII. LIVE BIRTH.

By live birth is meant simply that the fetus was born alive, and the definition of the term is entirely independent of the viability of the child, which latter term indicates the capability the child possesses of continuing to live.

A strict medico-legal rendering of the term live birth ignores entirely the immaturity, viability, and maturity of the child, and requires an answer only to the question, Was the fetus at the moment of expulsion alive? The test of a live birth differs in various countries; in Germany, crying "attested by unimpeachable witnesses"; in France, respiration; in Scotland, crying; in England and the United States neither breathing nor crying is essential to establish a live birth; the pulsation of the child's heart, or of one of its arteries, or the slightest voluntary movement is regarded as sufficient for this purpose (Reese). In regard to crying as a test of live birth, Coke remarks: "If it be born alive it is sufficient, though it be not heard to cry, for peradventure it may be born dumb." Legally, all we require for a live birth is anything to prove that the child was alive at the time when it entered the world.

IX. FEIGNED DELIVERY.

From a variety of motives, as for extorting damages or charity, compelling marriage, disinheritance, obtaining admission to some charitable institution, or for no assignable reason, women may simulate or feign delivery of a child. A careful examination of these cases if the simulated delivery is said to be recent, and if the various doubtful, probable, and certain signs of recent delivery are excluded, will clear away all doubt.* (See Signs of Recent Delivery, Part VI.) This condition in the lower animals is quite common, and has been repeatedly observed by dog-breeders. I have observed the phenomenon in the breeding of Scotch terriers. Years ago Harvey, in writing upon conception, stated that overfed bitches, which admit the dog without fecundation following, are nevertheless observed to be sluggish about the time they should have whelped, and to bark as they do when their time is at hand, also to steal away the whelps of another bitch, to tend and lick them, and also to fight fiercely for them. Others have milk or colostrum in their teats, and are, moreover, subject to the diseases of those which have actually whelped.

X. UNCONSCIOUS DELIVERY.

The possibility of a woman giving birth to a child even at full term, and remaining, for a time at least, unconscious of the fact, must be granted. The possibility of unconscious delivery is especially important in regard to the subject of infanticide; the defense in these cases often being that the woman was unconscious of the act of parturition. Unconscious delivery during the action of narcotic drugs and anesthetics, and in women in convulsions, stupor, coma, or moribund condition, is common, and women have been delivered unconsciously during profound sleep.† Unconscious delivery during hysteria is possible, but here as well as during sleep it is more than likely that the pains

* Compare Kost: "Text-Book of Medical Jurisprudence," Cincinnati, 1885, p. 189. Goodell, W.: "Medical News," Phila., 1890, LVIII, pp. 409–411. "Henke's Zeitschrift," vol. XLIV, p. 172. Fischer, C.: "Zeitschr. f. Wundärtze u. Geburtsh.," Hegnach, 1887, XXXVIII, pp. 264–268. "Ein forensicher Pseudo-Geburtsfall."

† For cases of unconscious delivery during sleep compare Weill: "Gaz. Méd. de Strasbourg," 1881, I, X, p. 103; Case, M. W.: "American Journal Med. Sciences," Phila., 1886, LV, p. 270; Samuelson, A.: "Brit. Med. Jour.," London, 1865, II, p. 550; Tarnier: "Journal des Sages-Femmes," Juillet 10, 1891.

of the expulsive stage of labor would arouse the woman; this is especially true of primiparæ, but every obstetrician is aware that in some women, particularly multiparæ with roomy pelves and relaxed soft parts, a very few and almost painless contractions of the uterus are sufficient to empty the uterus rapidly and easily. Perhaps the most frequent diseased condition in which a woman may be unconsciously delivered is the stupor, convulsions, or coma of puerperal eclampsia; as is well known, puerperal mania often follows this condition.

Under the preceding conditions it is quite possible for a woman to be confined, to injure or even to kill her child, subsequently to be restored to consciousness, and to be perfectly truthful in her assertion of her entire ignorance of what had happened, and the clinical picture of puerperal albuminuria or eclampsia would sustain her statements. Again, the expulsion of the child has been mistaken for a strong desire on the part of the woman to empty her bowels; this is a common defense set up for the charge of child murder. An intense desire to empty the lower bowel accompanies the expulsive stage of labor, and from our present knowledge of the subject, gleaned from many cases reported by competent observers, and from personal cases, a woman may be seized with this intense desire to defecate, hurriedly enter a water-closet or privy, and be absolutely ignorant of the act of parturition until too late to save the expelled child from injury. Such accidents are possible and have happened. Before the claim of such an occurrence is accepted in a given case, a thorough investigation should be made by the medical witness, including a vaginal examination of the woman in question.*

In addition, we must bear in mind that while the woman may in a given case be unconscious of the expulsion of her child at the moment of delivery, yet she cannot remain ignorant of the fact that she has been delivered, if she be at the time conscious.

XI. VERTEX PRESENTATION.

Definition.—A vertex presentation is, strictly speaking, an occiput presentation, the occiput being the region of the fetal head behind the posterior fontanelle including and surrounding the external occipital protuberances (Fig. 541). When this region forms the presenting part, there exists an occipital or so-called vertex presentation. This presentation affords the most natural posture for the fetus, the best opportunities for its favorable development, and at labor the best prognosis for both mother and child.

Frequency.—The frequency of vertex presentations is 96 per cent. of all cases. Compare Presentations, page 423.

* I was hurriedly summoned one night to a case of this character, in which a servant in the family, a primipara, out of wedlock, and at or near term, mistook a nearly painless labor for a difficult defecation, and the child was born in the pan of the water-closet. The patient complained of lumbo-sacral pains and rectal pressure and denied any knowledge of the escape of liquor amnii. Attempted infanticide was of course suspected, but an investigation satisfied all that there was no premeditated infanticide. The child lived, and it and its mother were removed the same night to a hospital.

In another case I was asked to see a woman in a New York tenement in which the patient, a multipara, was delivered precipitately on a fire-escape, in the act of leaning over the railing and exerting a good deal of strength in drawing a clothes-line loaded with clothes toward her; she was unaware of labor until the child, near term, struck the iron floor of the fire-escape. The child sustained contusions of the scalp and a depression of one parietal bone, but survived.

Etiology.—See Presentations, page 423.

Positions and Relative Frequency.—

I. Left occipito-anterior, Occipito-læva anterior, L. O. A., 70 per cent.
II. Right occipito-anterior, Occipito-dextra anterior, R. O. A., 10 per cent.
III. Right occipito-posterior, Occipito-dextra posterior, R. O. P., 17 per cent.
IV. Left occipito-posterior, Occipito-læva posterior, L. O. P., 3 per cent.

In vertex presentations the first position obtains in 70 per cent. of cases; the second in 10 per cent.; the third in 17 per cent.; and the fourth in 3 per cent. For the explanation of this relative frequency, compare Relative Frequency of Positions, page 424 (Fig. 577)

Mechanism.—I. Left Occipito-anterior Position, L. O. A. (Fig. 586).—1. *Flexion and Moulding of the Head.*—The sagittal suture in this position corresponds to the right oblique of the pelvic inlet, or possibly to a diameter between this and the transverse. If head flexion is complete, the suboccipito-bregmatic circumference, 11 inches (28 cm), is in relation with the circumference of the parturient inlet—the most favorable presentation (Fig. 586)

Flexion.—Most authorities associate flexion of the head upon the body with this stage. Possibly flexion is rendered more complete at this time, but a study of frozen sections of pregnancy and elective versions before labor has convinced the author that flexion is complete, or nearly so, before the onset of labor. The normal attitude of the fetal ellipse during pregnancy is one of flexion of all its parts (page 420). The causes of flexion prior and subsequent to labor are: (1) The normal attitude of the fetal ellipse during pregnancy is one of flexion of all its parts. (2) This flexion of pregnancy is increased or completed during moulding and entrance of the head into the inlet, because the sincipital pole of the head-lever is longer than the occipital pole; so that when the head encounters the resistance of the parturient inlet, the sincipital or long pole of the lever meets with greater resistance and ascends, forcing the chin nearer the sternum, and thus emphasizing or completing primary or gestational flexion (see page 422) (Fig. 577). If for any reason flexion be not complete, then possibly a circumference as great as the occipito-frontal (13½ inches—34.5 cm.) will be in relation with the circle of resistance of the parturient inlet. Complete antero-posterior flexion of the head is normally present at this time, and opinions differ as to the occurrence of lateral flexion or inclination. A lateral inclination of the fetal head toward the maternal sacrum bringing the sagittal suture nearer to the promontory than to the symphysis is termed Naegele's obliquity, or asynclitism (page 523). When the head descends with its planes parallel with the pelvic planes, a synclitic condition of the head is present. With normal pelves and fetuses the synclitic engagement of the head exists (Küneke); in labor with deformed pelves, especially with flattened pelves, Naegele's obliquity is sometimes found (see Pelvic Deformity, pages 604 and 605). By Solayres's obliquity (Fig. 586) is understood the entrance of the sagittal suture into the pelvic inlet in an oblique diameter. Roederer's obliquity is extreme flexion of the chin on the sternum (page 499).

Moulding.—In most labors adaptation of the skull to the pelvis is brought about by certain movements of the bones of the cranial vault upon one another. Moulding is an important and possibly an essential factor in the mechanism of labor, since it prepares the head for a ready engagement and descent, and the change in the shape of the head lowers the dip of the occipital pole of the head lever in the pelvis, thus favoring and rendering more positive anterior rotation of the occiput later on. Post-partum measurements show that the greatest reductions in the diameters take place in the transverse ones, which are often

lessened by twice the width of the sagittal and frontal sutures. The fontanelles also assist in the compression of the head, so that the transverse diameters are often diminished from $\frac{3}{5}$ to $\frac{4}{5}$ inch (1.5 to 2 cm.), and a corresponding elongation occurs in the sagittal diameters, but it can be shown by a study of many fetal skulls that the changes in shape of the skull in vertex presentations due to moulding consist not so much in actual measurable changes in the length of the head as in the flattening of the region about the brow and anterior fontanelle, an arching and greater prominence of the presenting part of the parietal bone, and, in prolonged labors, a more vertical position of the squamous portion of the occipital bone. A summary of the disposition of the bones of the skull due to moulding in vertex presentation is as follows: (1) The anterior or presenting parietal bone is the lowest presenting part, and it overlaps not only its fellow but also the frontal and occipital bones. Thus, in the two left positions of the vertex the left or posterior parietal bone is overridden by the right; and in the two right positions the right or posterior parietal bone is overlapped by the left (Figs. 582 to 585). (2) The half of the frontal bone which is posterior and toward the sacrum is overlapped by its neighboring bones and is slightly flattened by the pressure of the promontory. (3) Again the anterior or lowest parietal bone bulges more and becomes more prominent, while the posterior or higher parietal bone, which is against the sacrum, is forced toward the frontal bone and relatively flattened. Thus the halves of the skull are somewhat asymmetrical (Figs. 582 to 585). (4) The portion of the head which is lowest and constitutes the presenting part is often forced out into a point and forms the apex of a cone, the base of which corresponds to that plane which passes through the parturient canal first. Thus, in the L. O. A. position the suboccipito-bregmatic circumference or plane forms the base of a cone, the apex of which is the posterior superior angle of the right parietal bone. This explains the situation of the caput succedaneum and of a cephalhematoma. In ordinary cases deformity from moulding disappears in one or two days, and in the more pronounced cases in two to four days. In cases of contracted pelves with excessive moulding of the head, permanent deformity may result which perhaps can be positively determined only by taking a cast of the head, as measurements are misleading and unreliable.

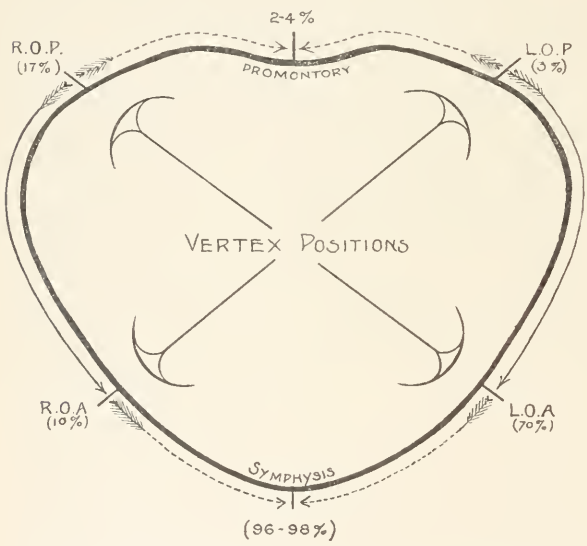

FIG. 577.—DIAGRAM SHOWING THE RELATIVE FREQUENCY OF THE POSITIONS OF VERTEX PRESENTATION.

The Caput Succedaneum.—The change in the shape of the head produced by moulding is still further modified by a swelling on that portion of the presenting part which is least subjected to pressure from the canal, due to venous hyperemia and œdema, and termed the caput succedaneum. (See Part IX.) In the L. O. A. position the caput forms upon the posterior superior angle of the right parietal

bone, encroaching somewhat upon the small fontanelle and occipital bone (Fig. 587). Wrinkling of the scalp usually precedes the formation of the tumor, and is indicative of commencing pressure. The scalp tumor may form within the bag of membranes before their rupture; after rupture of the membranes while the cervix is only partly dilated; and, thirdly, at the vaginal outlet after the head reaches the pelvic brim. In the first two instances the caput is usually small and of little practical importance, but at the vaginal outlet, where it usually forms, it may attain considerable size, and may enable one after delivery to diagnose the position the head occupied within the birth canal. While it is true that in normal labor the caput most often forms within the birth canal, still in contracted pelves, by reason of the resistance of the pelvic inlet, an enormous scalp tumor may form before the head enters the bony pelvis. Upon the sinciput the caput is usually larger than when situated upon the occiput, partly by reason of the greater laxity of the tissues in the former situation, and partly because of the longer duration of labor when the sinciput is directed to the front. In size the diameter may vary from one to two inches (2.5 to 5 cm.) or more. In left occipito-anterior positions the caput forms upon the superior posterior angle of the right parietal bone, overlapping somewhat the small fontanelle and occipital bone; in right occipito-anterior positions, upon the corresponding point of the left parietal bone; in right occipito-posterior positions the tumor develops upon the anterior superior angle of the left parietal bone, sometimes overlapping the frontal suture; in left occipito-posterior positions we find the caput upon the anterior superior angle of the right parietal bone, also often overlapping the frontal suture. In instances of a moderately rapid labor up to the time the head reaches the pelvic floor, and in instances in which the internal rotation of the head has been complete and the head is detained for a long period at the vaginal outlet, a large caput succedaneum often forms directly in the median line over the sagittal suture, and thus possibly obscures the diagnosis.

Fig. 578.—Diagram showing the Relation of the Lever-like Action of the Head to the Fetal Axis.

2. *Engagement and Descent of the Head* (Fig. 586).—It must be remembered that flexion, engagement, and descent of the head are often completed before labor actually sets in, this being specially true of primigravidæ (see Engagement and Descent, page 441). In these cases of ante-partum engagement and descent, head-flexion is completed or emphasized in the transit of the head through the

MOULDING IN VERTEX PRESENTATION.
ANTERIOR POSITIONS.

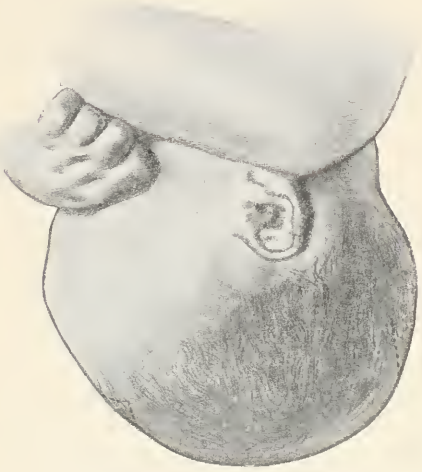

FIG. 579.—BEFORE MOULDING.

FIG. 580.—MODERATE MOULDING.

FIG. 581.—EXCESSIVE MOULDING.

cervix. Exceptionally because of a small head, or a softened and completely dilated cervix,—the latter in multiparæ,—the ring of the cervix does not enter as a factor into the causation of flexion. In exceptional cases only is Naegele's obliquity present, and usually the head enters the pelvis in the axis of the inlet with the biparietal diameter parallel with the plane of the inlet, and this relation of the head to the successive planes of the pelvis is maintained until the pelvic floor is reached. Engagement and descent go hand-in-hand, and the ease and promptness with which the latter is accomplished will depend upon the resistance encountered at the barrier of the cervix and in the walls of the pelvis and vagina.

3. *Anterior Rotation of the Occiput* (Figs. 588 and 589).—Descent continues until the most dependent portion of the presenting part—the occiput—reaches the pelvic floor. For reasons already set forth (page 442), anterior rotation of the occiput occurs so that it turns forward under the pubic arch, and the sagittal suture occupies very nearly the antero-posterior diameter of the bony pelvic outlet (Fig. 590). *Excessive rotation:* We occasionally see excessive internal rotation of the head, by which is meant that the sagittal suture rotates from one oblique pelvic diameter past the conjugate and into the opposite oblique. This is probably in consequence of excessive rotation of the trunk, due to strong uterine contractions compressing the fetal back and turning it toward the front and opposite side. In my sixty-nine observations in primiparæ, and seventy-one in multiparæ, excessive rotation of the head from one oblique diameter to the other occurred in but one instance—a primipara.*

4. *Extension and Expulsion of the Head* (Figs. 574 and 575).—Rotation

* Edgar: "The Mechanism of Labor; Some Experimental and Clinical Observations," "Amer. Journ. Obstet.," vol. XXVIII, No. 4, 1893.

being complete, there comes a time when, the occiput having passed under the subpubic ligament and being partially born, the shoulders attempt to enter the pelvis with the head; and as under ordinary circumstances there is not sufficient room for both, the head escapes from the vulva by a movement of extension. This is not strictly true, for repeated observations show that part of the head, including the occiput, is born before the chin leaves the sternum, a fact we must always remember in our attempts at perineal protection and forceps delivery (Fig. 573). This escape of the head is caused by the force of uterine contraction acting through the spinal column and by the contraction of the muscles that go to make up the pelvic floor; and we see the beautiful provision of nature that has caused only the smallest circumference—namely, the suboccipito-bregmatic, 13 inches (33 cm.)—to be passed through the birth canal; and even at the vulva, the occiput having been born first, all the circumferences of the fetal head that pass in succession through the vulval opening are measured not from the occipital protuberance, which is already born, but from a point midway between it and the foramen magnum, and are consequently the smallest or the suboccipital circumference (Fig. 574).

5. *Rotation of the Trunk and Restitution of the Head.*—The right or lower shoulder rotates to the pubis and the face looks toward the right thigh of the mother. (See Mechanism, page 447.)

6. *Expulsion of the Trunk.*—We have now followed the bisacromial diameter into the antero-posterior diameter of the pelvic outlet. The involuntary and voluntary forces direct the shoulders into the parturient outlet. *Shoulder delivery:*

MOULDING IN VERTEX PRESENTATION.
(AUTHOR'S COLLECTION OF SKULLS.)

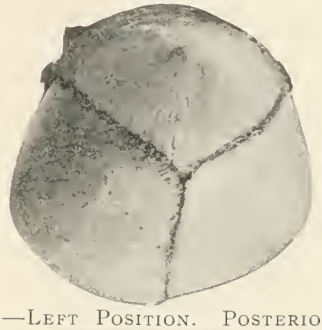

FIG. 582.—LEFT POSITION. POSTERIOR VIEW.

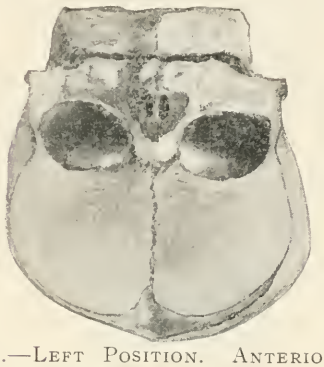

FIG. 583.—LEFT POSITION. ANTERIOR VIEW.

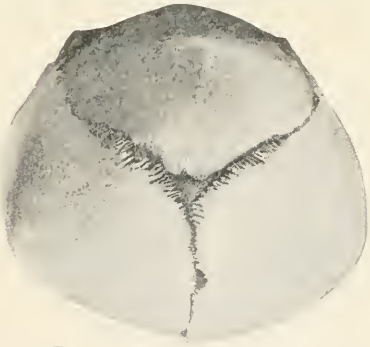

FIG. 584.—RIGHT POSITION. POSTERIOR VIEW.

FIG. 585.—RIGHT POSITION. ANTERIOR VIEW.

VERTEX PRESENTATION.

FIRST VERTEX POSITION.

LEFT OCCIPITO-ANTERIOR, L. O. A.

FIG. 586.—AT PELVIC INLET.

FIG. 587.—RIGHT PARIETAL BONE IN THE CERVIX.

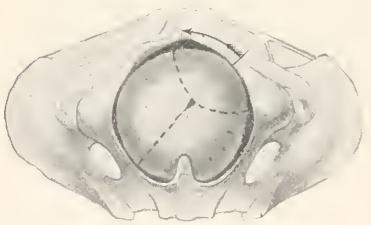

FIG. 588.—HEAD AT PELVIC FLOOR BEFORE ROTATION.

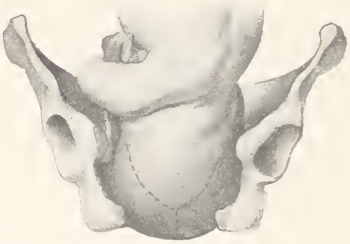

FIG. 589.—HEAD AT PELVIC FLOOR AFTER ANTERIOR ROTATION.

The right or anterior shoulder, whether it does or does not appear first under the arch of the pubis, is usually detained at this point, and the posterior or left or perineal shoulder, with arm and forearm, are propelled over the edge of the perineum and born, their escape being followed by the delivery of the right or pubic shoulder and arm (Fig. 620). With the birth of the shoulders the arms, forearms, and hands are usually found flexed upon the child's chest, as they are found in the normal attitude (see page 420). The shoulders having been delivered, the body usually follows immediately after. Some obstetricians would speak of a stage of rotation of the buttocks, but there is every reason to believe that when the shoulders rotate the buttocks rotate with them, in ordinary cases, and consequently there is little or no torsion of the body, but the buttocks come down and are expelled in the antero-posterior diameter of the outlet in practically the same way as are the shoulders.

II. RIGHT OCCIPITO-ANTERIOR POSITION, R. O. A. (Fig. 591).—(1) *Flexion and moulding of the head:* This stage in the mechanism is the same as in the L. O. A. position, except that the caput forms upon the posterior superior angle of the left parietal bone and the shape of the head and the overlapping of the bones differ (Fig. 592). (2) *Engagement and descent:* The sagittal suture enters the left oblique diameter of the pelvic inlet and descent occurs as before until the pelvic floor is reached (Fig. 593).

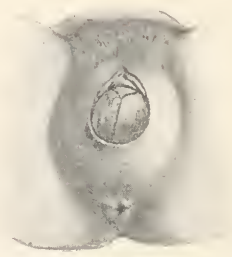

FIG. 590.—IN THE VULVA, WITH INCOMPLETE ANTERIOR ROTATION.—(*From a photograph.*)

SECOND VERTEX POSITION.

RIGHT OCCIPITO-ANTERIOR, R. O. A.

FIG. 591.—AT PELVIC INLET.

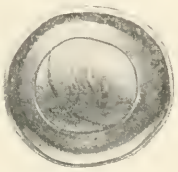

FIG. 592.—LEFT PARIETAL BONE IN THE CERVIX.

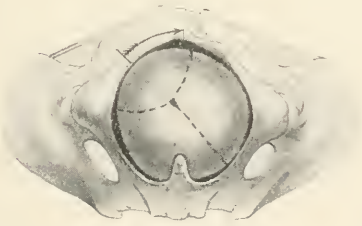

FIG. 593.—HEAD AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION.

FIG. 594.—HEAD AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION.

(3) *Anterior rotation of the occiput:* This occurs, for reasons already stated, from right to left instead of from left to right as in the L. O. A. position (Fig. 593). (4) *Extension and expulsion of the head* are the same as in the L. O. A. position. (5) *Rotation of the trunk:* The bisacromial diameter of the shoulders enters the right oblique diameter of the pelvic inlet and the rotation of the trunk causes the left shoulder to come under the pubic arch. (6) Expulsion of the trunk is the same as in the L. O. A. position, as regards anterior and posterior shoulder delivery (Fig. 620).

III. RIGHT OCCIPITO-POSTERIOR POSITION, R. O. P. (Fig. 596).—1. *Flexion and Moulding of the Head.*—This stage is the same as in the R. O. A. position, except that the flexion is liable to be imperfect. The caput succedaneum develops upon the anterior superior angle of the left parietal bone, sometimes overlapping the frontal suture (Fig. 597), and the shape of the head and the overlapping of the bones differ (Figs. 584 and 585).

2. *Engagement and Descent of the Head.*—The suboccipito-bregmatic diameter in this position enters the inlet in its right oblique diameter. Following engagement we have descent, in some cases until the pelvic floor is reached, and in others anterior rotation of the vertex occurs before the pelvic floor is reached. In these latter instances there is every reason to believe that it is the resistance of the posterior

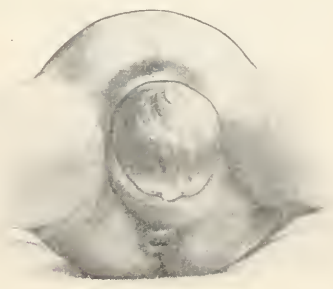

FIG. 595.—HEAD EXPULSION AFTER ANTERIOR ROTATION.—(*From a photograph.*)

wall of the uterus or of the recto-vaginal septum that determines this early rotation (Fig. 530).

3. *Rotation of the Occiput.*—When once the vertex has reached the pelvic floor, the case may terminate in one of four ways, and, in order of frequency, they are as follows: *First*, complete anterior rotation of the occiput about the right half of the pelvis until the pubis is reached; *second*, posterior rotation of the vertex into the hollow of the sacrum and birth of the head with the occiput to the rear by extension over the perineum; *third*, posterior rotation and impaction; and, *fourth*, the conversion of the vertex presentation into one of face presentation; and although this latter termination is extremely rare, some instances of it are on record, and we are compelled to recognize its possibility (Fig. 538). (1) *Anterior rotation:* It is unnecessary to describe the first method of termination; the same principles apply here as in the first and second positions. The greater resistance of the posterior segment of the pelvic floor causes the occiput to be deflected in the direction of least resistance—namely, to the vulval orifice (Fig. 599). (2) *Posterior rotation and birth of the occiput over the perineum:* Instances occur, however, in which from some cause, as roominess of the pelvis, smallness of the child, want of rigidity of pelvic floor from numerous labors, or other causes,—distention of the floor by the passage of the first twin, incomplete flexion of the head, permitting the sinciput to be as low as or lower than the occiput,—anterior rotation fails. Most authorities state this to be a rare condition, yet according to Naegele's statistics it occurred once in 73 cases of labor. In 2200 labors I found persistent occipito-posterior position to occur in 89 cases of labor, or 4.04 per cent. Should anterior rotation fail and the occiput remain in the posterior half of the pelvis, it is possible under certain conditions for the occiput to follow the posterior wall of the parturient canal and to be born by extension over the edge of the perineum. Labor then is almost always prolonged, and in some instances impossible as the result of impaction (Fig. 601). The cause of the prolongation of the labor under such circumstances was first pointed out by P. Dubois, and is readily understood. The back of a child's neck (Fig. 544) is not much over 3 inches (7.5 cm.) in

THIRD VERTEX POSITION.
RIGHT OCCIPITO-POSTERIOR, R. O. P.

FIG. 596.—AT THE PELVIC INLET.

FIG. 597.—LEFT PARIETAL BONE IN THE CERVIX.

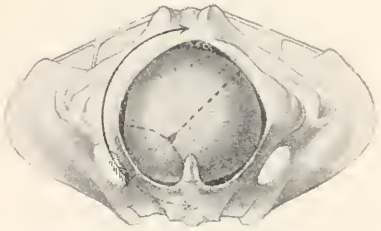

FIG. 598.—VERTEX AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION.

length; the posterior wall of the parturient canal, from the promontory of the sacrum to the edge of the perineum (Fig. 516), is in the neighborhood of ten inches (25 cm.), counting five inches from the promontory to the tip of the coccyx and five more from this point to the edge of the distended pelvic floor. If an anterior position of the vertex obtains, the birth of the head is readily and easily accomplished; for the two inches of the back of the neck without any difficulty pass over the $1\frac{5}{8}$ inches (4 cm.) of the anterior pelvic wall measured at the symphysis, and the head is born before the shoulders necessarily enter the pelvic inlet. For the head to be born in an occipito-posterior position we may hope for no break in the straight and rigid mass that the fetus represents, until the head together with the neck has traversed the ten inches of the posterior pelvic and perineal walls, and the head is finally permitted to be born over the perineum. Delivery under such circumstances is certainly possible by the natural forces, for after an exceedingly tedious labor and extreme flexion of the head on the sternum, and the occiput distending the pelvic floor for several hours, finally with tremendous bearing-down efforts on the part of the parturient woman, the occiput is enabled to climb up, as it were, over the edge of the perineum, the forehead and face appear at the pubes, and the perineum slipping by the occiput and along the neck, extension completes the birth of the head. (3) *Posterior rotation and impaction:* Unfortunately we occasionally meet with instances in which anterior rotation of the occiput or spontaneous delivery of the occiput to the rear both fail to occur. And if we have added an impaction and swelling of the shoulders that have partially entered the pelvic cavity, we have one of the tragedies of midwifery practice. Given a normal-sized fetus, a pelvis of ordinary dimensions, perhaps a primipara with rigid soft parts, and the cause of impaction of those cases of occipito-posterior position that have been improperly treated in the early second stage of labor is easily understood. The occiput passes into the hollow of the sacrum, reaches the coccyx perhaps, but still is several inches (5 inches) from the edge of the perineum. Under the circumstances the body of the child must enter the pelvic cavity with the head in order to allow of the occiput's reaching the edge of the perineum. We have impaction then because the dorso-sternal diameter, $3\frac{3}{4}$ inches

THIRD VERTEX POSITION.—(Cont.)

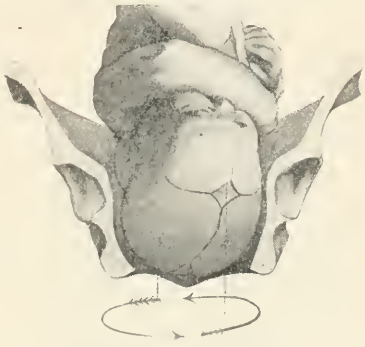

FIG 599.—VERTEX AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION.

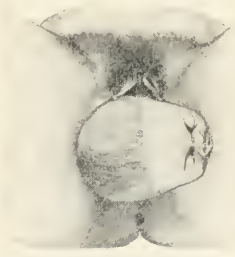

FIG. 600.—RESTITUTION OF THE HEAD AFTER ANTERIOR ROTATION AND EXPULSION.

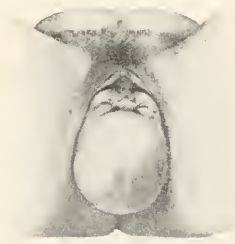

FIG. 601.—DELIVERY OF THE HEAD AFTER POSTERIOR ROTATION OF THE OCCIPUT.

(9.5 cm.) (Fig. 544), is added to the fronto-mental diameter, $3\frac{1}{4}$ inches (8.25 cm.) (Fig. 533), giving an antero-posterior diameter of the presenting fetal mass of 7 inches (17.78 cm.) that the uterine forces are attempting to drive through a pelvis the average diameter of which is usually not more than $4\frac{3}{4}$ inches (12 cm.) (Fig 509). And this is not all; the length of the fetal ellipse when the child is in normal attitude is half the length of the entire fetus—namely, about 11 inches (27.5 cm.); consequently when the occiput has come to the edge of the perineum the breech of the child has practically entered the inlet of the pelvis, and the uterus under such circumstances cannot but act at a disadvantage. We can readily see, then, what either spontaneous or artificial birth of the fetus means to the mother—almost invariably a partial or complete loss of her perineal structures, or uterine inertia and exhaustion (Fig. 601). (4) *Conversion into a face presentation:* The fourth manner in which this posterior position may terminate is for the occiput in some way to become arrested in its course, and then, the chin leaving the sternum, rotation on a biparietal diameter takes place, the head, as it were, turns a somersault, becomes extended within the pelvic cavity, and we have resulting a face presentation of the mento-anterior variety. This is of rare occurrence spontaneously. A few manual conversions of an occipito-posterior position into a face presentation within the pelvis have been reported.

FOURTH VERTEX POSITION.
LEFT OCCIPITO-POSTERIOR, L. O. P.

FIG. 602.—AT PELVIC INLET.

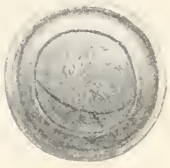

FIG. 603.—RIGHT PARIETAL BONE IN THE CERVIX.

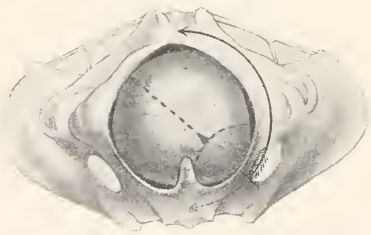

FIG. 604.—VERTEX AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION OF THE OCCIPUT.

4. *Expulsion of the Head.*—If, as happens in all but 1.5 per cent of cases, anterior rotation of the occiput about the right half of the pelvis to the pubis occurs, the head delivery is the same as in the R. O. A. position (Fig. 606).

5. *Rotation of the Trunk.*—The shoulders enter the pelvis with the bisacromial diameter in the left oblique pelvic diameter, and the left anterior or lowest shoulder naturally rotates to the pubis.

6. *Expulsion of the Trunk.*—After shoulder rotation this is the same as in the R. O. A. position.

IV. LEFT OCCIPITO-POSTERIOR POSITION, L. O. P. (Fig. 602).—(1) *Flexion and moulding of the head:* This stage is the same as in the L. O. A. position, except that the flexion is liable to be imperfect, the caput succedaneum develops upon the anterior superior angle of the right parietal bone, often overlapping the

frontal suture (Fig. 603), and the shape of the head and overlapping of the bones differ somewhat (Figs. 582 and 583). (2) *Engagement and descent of the head:* The suboccipito-bregmatic diameter in this position enters the left oblique diameter of the inlet (Fig. 602). Descent now occurs as in the L. O. A. position (page 453). (3) *Rotation of the occiput:* The same general principles govern the further progress as in the R. O. P. position, except that backward rotation in the 1.5 per cent. would occur from left to right, and the anterior rotation which usually occurs takes place around the left side of the pelvis to the pubis (Figs. 604 and 605). Delivery or impaction in occipito-posterior cases is the same as in the R. O. P. position (page 458). (4) *Expulsion of the head:* If, as happens in all but 1.5 per cent. of cases, anterior rotation of the occiput about the left half of the pelvis to the pubis occurs, the head delivery is the same as in the L. O. A. position (Fig. 590). (5) *Rotation of the trunk:* The bisacromial diameter enters the right oblique diameter of the inlet, and the right or anterior or lowest shoulder naturally rotates to the pubis (Fig. 576). (6) *Expulsion of the trunk:* After shoulder rotation this is the same as in the L. O A. position (Figs. 620 and 621).

FOURTH VERTEX POSITION.—(Cont.)

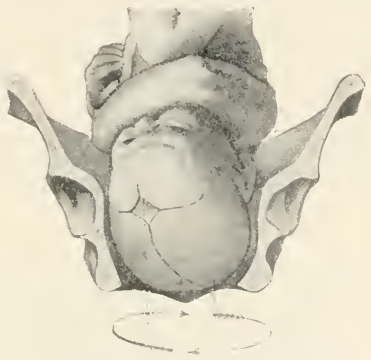

FIG. 605.—VERTEX AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION OF THE OCCIPUT.

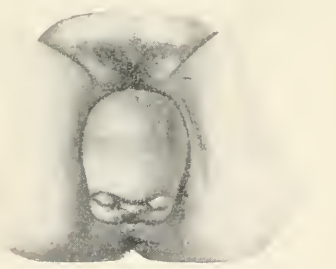

FIG. 606.—EXPULSION OF THE HEAD AFTER ANTERIOR ROTATION OF THE OCCIPUT.

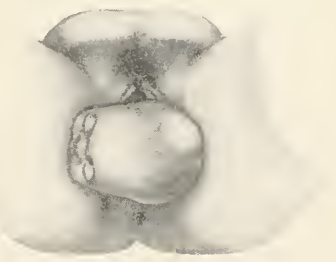

FIG. 607.—RESTITUTION OF THE HEAD.

Diagnosis.—One may be required to make the diagnosis of vertex presentation (1) during pregnancy, (2) during labor, (3) after labor has been completed.

1. *During Pregnancy* (see table on page 463).—The diagnosis of vertex presentation during pregnancy before the os is sufficiently dilated to permit of distinguishing sutures or fontanelles, or the character of the presenting part, is made by external or abdominal palpation (see page 463).

2. *During Labor.*—Abdominal palpation may be carried out as well during labor between the pains. When labor has advanced far enough for us to palpate the vault of the skull, the diagnosis of vertex positions is made from the position and character of the fontanelles and sutures which we can palpate. Vertex presentations are recognized by the characteristic sensation of a hard and globular head, which soon becomes familiar to the student. The diagnosis of the position must be made by mapping out the sutures and fontanelles. This is apt to puzzle the beginner, and is sometimes difficult for the experienced obstetrician, and can be learned only by practice upon the manikin and at the bedside (see Figs. 587 and

592). On entering the os uteri the finger usually finds first the anterior parietal bone, and behind this the sagittal suture. Taking this suture as the chief landmark, and remembering that it has a fontanelle at each end, the examining finger undertakes to find these fontanelles or one of them. Following the sagittal suture downward and forward, the small (occipital) fontanelle is found toward the mother's left if the position be an L. O. A., or toward her right if it be an R. O. A. The beginner should not forget that the small fontanelle, as soon as the uterine contractions commence to force the head into the pelvic brim, is not an opening, but only an angle formed by the posterior borders of the parietal bones and the anterior edge of the occipital. Following the sagittal suture back from the posterior fontanelle, the finger may reach the large, soft anterior fontanelle, and the student should not be satisfied with his diagnosis unless he has recognized both fontanelles. If the head is well flexed, the posterior fontanelle may be the first thing encountered by the finger, and the anterior fontanelle may be so far back that to reach it is difficult. Important points for the student to remember are that from the posterior fontanelle run three sutures, from the anterior fontanelle, four; that a posterior fontanelle easily reached denotes good flexion of the head, and that an anterior fontanelle easily reached denotes small size of head, incomplete flexion, bregma presentation, or a posterior position of the occiput. An exact diagnosis by sutures and fontanelles is by no means essential in every apparently normal case before rupture of the membranes, and to insist upon it is to expose the patient to the danger of premature rupture of the membranes and septic infection. Palpation of the anterior or lower ear is a valuable diagnostic sign (Fig. 608).

FIG. 608.—THE PALPATION OF THE ANTERIOR OR LOWEST EAR OF THE FETUS AS A MEANS OF POSITIVE DIAGNOSIS OF THE POSITION.

3. *After Labor.*—After labor is completed we are sometimes called upon, for medico-legal purposes, to express an opinion regarding the presentation in which the child was born. We usually rely on two points in making the diagnosis of presentation at this time. First, the shape of the child's head; and, second, the position of the caput succedaneum. When labor has been rapid, when there has been no caput, and when little or no moulding has occurred, there is nothing by which we may be enabled to express a positive opinion, and there is nothing in the genital canal of the woman to aid us in making our diagnosis.

Prognosis.—Vertex presentation offers the best prognosis for both mother and child, but it varies slightly with the position,—the anterior being more favorable than the posterior, since in the latter cases the labors are generally longer and more difficult, while the forceps is necessary about once in seven cases. The soft parts are more frequently torn. The maternal mortality is less than 1 per cent. when the case is intelligently managed. The fetal mortality is 5 per cent. in anterior vertex positions, and is increased to over 9 per cent. in posterior positions.

DIAGNOSIS OF VERTEX POSITIONS.

	Position of Fetus.	Position of Fetal Heart-sounds.
Left occipito-anterior, L. O. A.	Occiput to left acetabulum, forehead to right sacro-iliac joint; back to left; extremities to right, above.	Below and to the left of umbilicus.
Right occipito-anterior, R. O. A.	Occiput to right acetabulum, forehead to left sacro-iliac joint; back to right; extremities to left, above.	Near median line, below umbilicus.
Right occipito-posterior, R. O. P.	Occiput to right sacro-iliac joint, forehead to left acetabulum; back in right flank; extremities to left, anteriorly.	In right flank, below a transverse line through umbilicus.
Left occipito-posterior, L. O. P.	Occiput to left sacro-iliac joint, forehead to right acetabulum; back in left flank; extremities to right, anteriorly.	In left flank, below a transverse line through umbilicus.

XII. THE MANAGEMENT OF LABOR.

Imitation of nature is the key to the management of normal labor. By management is not meant interference, but watchful observation. A proper understanding of this fundamental principle will serve to do away with much meddlesome and injurious practice. In fact, it is not too much to say that in normal cases the object of the accoucheur is to find out, not how much, but how little interference is justifiable. The desire of the student to see and to study abnormal cases should be restrained until he has become thoroughly familiar with the phenomena and natural course of normal labor. It is scarcely an exaggeration to state that the greater proportion of the morbidity if not the mortality of child-birth is due to the careless and unskilful management of normal labor. Meddlesome midwifery, sins of commission, may be dangerous; it is equally so in obstetrics to adhere too closely to the modern dictum, that there shall be no interference without a positive indication. Let him or her beware who adopts the latter course and follows it without a thorough familiarity with the physiological processes of normal labor and the many and varied dangers which may suddenly and unexpectedly arise during child-birth. Imitation and a watchful expectancy, not a blind, unreasoning trust in the processes and powers of nature, should guide us in the management of labor. What apparently begin as the simplest labors will often subsequently demand active interference on the part of the attendant. The whole process of labor, properly considered, is a conservative process the tendency of which is to prevent sepsis, and it should be our aim not to thwart this process or supplant it by methods of art, but to follow and aid it, interfering only when, for one reason or another, the resources of nature prove insufficient. Nature's processes in labor are from within outward. The fetus starts on its journey through the parturient canal from the sterile uterine cavity, passes through the aseptic cervix, continues on its way through the vagina, a tube which while often containing bacteria,

even of those species which are sometimes pathogenic, may still be regarded as sterile in the majority of cases, and only at the point of final expulsion comes in contact with a surely septic surface, at a time when such contact can do no harm. In other words, the fetus passes from the clean to the relatively clean, and finally to the unclean. Moreover, during and after the journey of the fetus through the birth-canal nature has provided additional safeguards against infection, notably the physiological increase of the vaginal mucus, which while its germicidal power has doubtless been greatly overestimated may at least be regarded as in most cases unfavorable to the multiplication of bacteria, and which attends the normal progress of the first and second stages of labor; the flushing of the canal from within outward by the aseptic, saline liquor amnii at the end of the first stage; by a second flushing of the canal by a rush of aseptic saline blood and liquor amnii at the termination of the second stage; at the termination of the third stage the cleansing process is completed by the outward passage of the placental mass and the subsequent flow of blood. Then follow quickly the reparative processes of nature to close the open blood-vessels and lymphatics. While, as we thus see, all nature's processes are from within outward and conservative,—from the sterile toward the septic,—manipulations on the part of the obstetrician must necessarily be from without inward—from the unclean toward the clean. It is also probable that the microörganisms of the external genitals have an intrinsic tendency to migrate to the vagina, and to invade the puerperal uterus, and even the uterus in labor; and that they are able to prevail at times even in the face of the conservative forces just enumerated. Hence the importance of non-interference except in the presence of a positive indication.

Prophylaxis.—While in the management of pregnancy we can, as a rule, act only indirectly as far as gynecological prophylaxis is concerned, we can in the management of labor do a great deal which is of positive and immeasurable benefit to the patient in preventing subsequent serious and perhaps lifelong disability.

Limiting the Duration of Labor.—That a labor prolonged beyond the limits of safety is of itself the cause of subsequent local trouble is well known. This statement is applicable to all kinds of abnormal labor, but finds its best application in cases in which local sloughing of the maternal parts (leading sometimes to vesico-vaginal fistula) is caused by prolonged pressure of the fetal head. Maternal lesions may be the result not only of the premature or unskilful use of the forceps, but also of undue delay in its use. To lay down exact rules, as some have attempted to do, as to the time which should be allowed to elapse before the application of the forceps without reference to the individual case, is wrong. Many other circumstances must guide us here. But it is safe to say that when with good uterine contractions the head remains stationary, the danger of injury to the maternal soft parts becomes an important factor. A similar danger also arises from too prolonged efforts to retard the passage of the head through the vaginal outlet in order to prevent laceration of the perineum. I refer here not only to the dangers arising from prolonged pressure, but also to permanent relaxation of the muscular structures of the pelvic floor, with resulting disability.

Prompt Surgical Treatment of Traumatism.—It should be the aim of the obstetrician to leave his patient in at least as good condition as that in which he finds her, and no man should attempt the care of the lying-in patient who does not understand the ultimate results of the more common lesions of the genital tract which may accompany the parturient act, and the methods

of their repair. Not long ago, when trachelorrhaphy was a very common operation, and when the importance of cervical lacerations with reference not only to the etiology of cancer but of various lesser troubles was overrated, the immediate suture of cervical lacerations was advocated in many quarters. With the advent of more correct views, however, the majority of obstetricians do not favor the immediate repair of cervical lacerations unless required by severe hemorrhage. The danger of sepsis is by no means inconsiderable. The importance of the immediate repair of all lacerations which endanger the muscular structure of the pelvic floor is now generally recognized.

Asepsis.—Most important of all in connection with prophylaxis during labor is rigid attention to asepsis and antisepsis. The importance of septic infection as a factor in the production of uterine and pelvic disease is too evident to need comment. One fact, however, I desire to emphasize: viz., that what is called antiseptic midwifery, while it has enormously decreased the mortality from puerperal infection, has by no means had a corresponding effect upon the morbidity. We are too prone to consider only mortality in our results and to pass over entirely the question of morbidity. Even to-day the influences upon morbidity, the ultimate consequences of a mild puerperal process, are too apt to pass unrecognized by the obstetrician, and the case passes into the hands of the gynecologist for the cure of chronic uterine and peri-uterine inflammation, which had its origin in an unnecessary, if not careless, vaginal examination. We hear much of a lowered mortality, and little or nothing of a reduced morbidity.

Preliminary Preparations.—(1) The obstetric outfit. (2) Mother's outfit. (3) Baby's outfit. (4) Physician's obstetric bag. (5) The obstetric nurse. (6) The lying-in room. (7) The labor bed. (8) Articles to be in readiness at time of labor.

1. The Obstetric Outfit.—Shall the obstetric outfit be prepared by the patient or nurse, or shall it be procured already prepared from some dealer in surgical dressings? A further question naturally suggests itself—namely, Of what does the obstetric outfit to-day consist? Aside from the mother's outfit, meaning the clothes she will need during her lying-in period, and the "baby's outfit," including, if possible, a "baby's basket," the obstetric outfit should include at least the following articles: (1) A douche pan, preferably square and of enamel or agate-ware. (2) Two ordinary rubber blankets, or two pieces of rubber sheeting, one one yard square and the other two yards square. (3) Three or four dozen soft napkins for vulval dressings, or the same number of vulval pads from a surgical-dressing dealer. (4) One or two pounds of sterilized absorbent cotton, or twenty-five yards of cheese-cloth or sterilized gauze, for sponging. (5) Six abdominal binders of soft muslin or mull, eighteen inches wide and preferably made to fit the figure at the sixth month of gestation. (6) Two hand-brushes. (7) Some old linen for the baby's eyes and mouth. (8) Four ounces of tincture of green soap. (9) Bottle of sublimate tablets. (10) Seven ounces of chloroform. (11) Four ounces of boric acid, powdered. (12) One tube of sterile white vaseline (for the baby). (13) Small and large safety-pins and bank-pins.

If there is no nurse available before labor sets in, and it is necessary for the patient to see to the cleansing of the above articles, she may be instructed to pin the douche pan, rubber sheeting, and hand-brushes separately in coarse kitchen towels and boil them for half an hour in an ordinary wash-boiler. The articles so boiled are then dried without removing the towels, put away, and not opened until the time of labor. The soft napkins, if these are to be used for vulval dressings, should, freshly laundered, be pinned, half a dozen in a package, in coarse kitchen towels, and put away until the onset of labor. The nurse is then

instructed to sterilize one package at a time by placing it in the oven until the outer covering is scorched. For sterilizing instruments and dressings in the oven of the kitchen range, one only requires a thermometer graduated to 200° C., so as to prevent the temperature rising too high, and to make sure that 140° C. is obtained. The absorbent cotton, the old linen for the baby's eyes, and the cheese-cloth are treated in the same way, the two latter being cut up into convenient pieces and sterilized as needed. It is sufficient that the abdominal binders be thoroughly laundered and pinned separately in freshly laundered towels until needed. It will be noted that the time-honored douche bag and tube have not been referred to, and this is because I do not employ douches except for positive indication; and, further, because I believe these articles should be part of the physician's outfit, sterilized and cared for under his direct supervision.

Most or all of the articles contained in the above list of the "obstetric outfit" can to-day be obtained, sterilized in their final wrappers and ready for use, from many of the dealers in surgical dressings (notably, Van Horn & Co., New York; Kalish, New York; Johnson & Johnson, New York; Fraser & Co., New York), at prices for the outfit varying from four to thirty dollars. These obstetric outfits, cleansed and sterilized, are usually packed and sealed in a neat box, thus allowing the contents to be kept intact until needed. The contents of these outfits vary somewhat in detail, but the following list contains the essentials: (1) Agate-ware (square) douche pan. (2) Sterilized bed pads. (3) Sterilized vulval pads. (4) Sterilized absorbent cotton. (5) Sterilized absorbent gauze. (6) Two pieces of rubber sheeting or two ordinary rubber blankets, one for permanent labor bed and the second for the draw-sheet. (7) Abdominal binders. (8) Glass and rubber catheters. (9) Scrub- and hand-brushes. (10) Sterilized tape for cord. (11) Sublimate tablets; boric acid powdered; chloroform; ergot; borated talcum powder; soap; tube of sterile vaseline; safety-pins.

2. Mother's Outfit.—(1) A number of merino or flannel undervests to be changed night and morning, to secure free skin action and prevent chilling. (2) Long night-dresses to be changed once a day. (3) Warm flannel wrap or dressing sacque. (4) Abdominal binders of soft muslin, half a yard wide and made to fit the figure at the sixth month of gestation. (5) Breast binders for large and pendulous breasts, plain muslin or ordinary corset-covers (see Part VI). An abundance of old linen sheets and a generous supply of towels.

3. Baby's Outfit.—Should be plain, so as to withstand frequent washing; with long sleeves and high neck to secure warmth, since cold is so injurious to the newly born, and loose and light in weight, so as not to impede any organ in the body. (1) Soft flannel undershirts with high neck and long sleeves, open in front so as to be easily removed or adjusted. (2) Four-inch, soft flannel binders to go round the abdomen and lap one-third, which should not be hemmed but overstitched, and should be secured to the child with tapes or sewed. (3) Cotton or linen diapers, which should not be of canton-flannel. When folded once, the diaper is half a yard square (to fasten with safety-pins). A second napkin is sometimes necessary. (4) Heavy or light, according to season, flannel slip to act as bath petticoat and dress, open and fastened in front. (5) Knit woolen socks reaching nearly to the knee. Cold feet are often an exciting cause of colic. White muslin slip may, if desired, be worn over flannel slip. When there is little hair on the head, a plain cambric or light flannel cap will prevent nasal catarrh. *Baby basket:* The ordinary contents are: (1) Bobbin. (2) Scissors. (3) Safety-pins. (4) Soft linen (4 by 4) in boracic acid solution for cleansing cord, eyes, and mouth. (5) Soft hair-brush. (6) Powder box of lycopodium or fine starch powder. (7) Tube of sterilized white vaseline. (8) Soft towels. (9) Complete change of clothing. (10) Woolen shawl, blanket, or wrap.

4. The Physician's Obstetric Bag.—For several years I have experimented with different patterns of bags and cases in order to fulfil the requirements of private practice. I have always looked on leather obstetric bags with suspicion and fear, because of the difficulty of cleansing them, and because articles to be used in the lying-in room cannot be safely carried in them unless such articles and instruments are boiled immediately before use; further, I believe that the ordinary obstetric leather bag which has been from one case to another, in cabs and street-cars, which of necessity has had its interior soiled by bloody fingers and instruments, green soap, ergot, or other drugs, has no place in the lying-in room in the present age of aseptic surgery. Leather obstetric bags can, therefore, not be recommended, because of the difficulty, if not impossibility, of cleansing them. Linen obstetric bags which can be boiled or sterilized by steam have been used in Germany. Dührssen has an asbestos bag which can be sterilized by dry heat with the instruments *in situ*. Aluminium I have found unsuitable by reason of the uncertain composition of the metal. The ideal obstetric case is one made entirely of metal

which will permit of cleansing by dry heat, steam, or boiling. Such a case may be contained for transportation in a suitable holder or bag. The bag-shaped cover is preferable because more convenient and conventional. The great disadvantage of a metal case, aside from its greater cost, is its additional weight. The aseptic metal obstetric case, which is here recommended, is the result of much experimenting, and weighs but six pounds more, including leather holder, than an ordinary leather obstetric bag. The weight of the case complete with glassware filled, and including a Tarnier forceps, is twenty-five pounds. This increased weight can be further reduced some two pounds by the use of lighter metal in the manufacture of the case. From actual experience extending over a period of several years I believe that the inconvenience of the additional five or six pounds is more than overbalanced by the many advantages of such a case, not the least of which is cleanliness.

The case practically consists of two trays, male and female, made of sheet-iron and enameled in white at a temperature of several hundred degrees (Fig. 609). The male or larger tray measures 17 × 8 × 6 inches, partially fits into a shallower female tray (17 × 8 × 3½ inches), leaving a space of two inches, in which space is contained a third tray made of canvas, with loops and compartments to contain the glassware of the case. A leather holder or case covers both trays when fitted together, and strong straps hold all firmly together. My objects in having the case thus made of two trays, one large and the other small, and both enameled at a high temperature, with an inner canvas tray to contain the glassware, are as follows:

1. The case is aseptic. The case proper can always be rendered sterile before being taken to a confinement by boiling, by baking in an ordinary kitchen oven, or by steam under pressure, as the size of the case permits its being sterilized in the medium-sized steam sterilizer of the market. No matter what the character of the complication attended, be it ever so septic, or instruments, douche bag, catheter, gown, etc., ever so soiled with pus or blood when thrown into the case to be carried away, the entire outfit can be placed in a wash-boiler and rendered sterile in a short period of time by boiling.

2. Such a case furnishes us at the bedside, after the canvas tray is removed from the smaller tray and the contents from the larger, with two sterile receptacles which may be put to a number of uses and will often prove most valuable and convenient. For example: aside from a supply of hot water in an emergency, nothing more need be required to conduct a confinement than the case and its contents; as the larger tray, which holds, when half-full, six quarts, may be used to wash the hands and forearms in soap and water, and the smaller female tray, which holds, when half-full, three quarts, to disinfect the hand and forearm in sublimate solution.

3. The length of this tray (seventeen inches) permits of the entire forearm being submerged in the sublimate solution, an advantage that will quickly be appreciated by the surgeon (Fig. 609).

4. I am in the habit of using the smaller, female tray as a sterilizer. When in the course of labor indications point to the use of forceps, the instrument, still secured in its labeled canvas case, is placed in the smaller tray of the case and sent to the kitchen to be boiled for an hour. The boiling water is poured off in the kitchen, and, the forceps still in its case, is brought in the tray to the bedside, and the case is opened only after the patient and the operator's hands have been prepared for operation.

5. The larger tray, again, by reason of its size, makes an excellent bath in which to plunge an asphyxiated child, and one has always at hand a convenient bath-tub in which a modified Byrd's method of artificial respiration can be carried on, the child being meanwhile submerged in very hot water (Fig. 609).

6. The advantages of the inner canvas tray, which rests in the space between the two metal trays, will be readily appreciated. This tray is practically a canvas case measuring 17 × 8 × 2 inches, with a lid, and canvas handles at either end to lift it out of the smaller metal tray (Fig. 609). My object in using canvas here, with a separate loop or compartment for each piece of glassware or instrument, was to secure a noiseless tray for this part of the physician's obstetric outfit, one in which the articles are all in plain sight, so as to be selected at an instant's notice, and one, moreover, that can be repeatedly cleansed by boiling whenever soiled by bloody fingers, soap, vaseline, or ergot.

7. The case as a whole is readily converted into an obstetric operating case by the addition of the desired instruments pinned in towels and placed in the larger of the two trays for which purpose sufficient room has been provided. The length of the large tray permits of Tarnier's forceps, a cranioclast, and a cephalotribe being carried in it.

Contents of the Case.—(*a*) *In large male tray:* (1) Clean apron. (2) Kelly pad. (3) Canvas lithotomy sling. (4) Four-quart sterile douche bag in canvas case. (5) Metal receptacle containing sterile vaginal and douche tubes and glass catheter. (6) Volsella,

FIG. 609.—THE AUTHOR'S OBSTETRIC CASE.—(*From a photograph.*)

dressing, needle and tongue forceps, and scissors in canvas case. (7) Obstetric forceps in canvas case. (8) Sterile cotton and plain gauze. (9) Five per cent. iodoform gauze. (10) Two sterile nail-brushes. (11) Rubber gloves.

The two metal and the one canvas tray having been cleansed by boiling or by dry or moist heat, as already described, each of the various articles contained in the above list is cleansed in a different manner in order to secure surgical cleanliness. (1) The apron or canvas suit is simply freshly laundered. (2) The Kelly pad is cleansed with laundry soap, hot water and a brush, and finally with a 1 : 20 carbolic acid solution; should the pad be used about a case in which a suspicion of sepsis exists, it is boiled for half an hour. (3) The Kelly canvas lithotomy sling is made of canvas, galvanized iron rings, and brass buckles, and is boiled for half an hour after use. (4) The four-quart douche bag and tubing are, after use, scrubbed with hot water, soap, and a brush, rinsed in clean hot water, placed in its canvas case, and boiled for half an hour. The towel and bags are then allowed to dry in an enamel-ware vessel over the kitchen range, and when dry are placed in the case. (5) The metal receptacle containing the glass douche tubes and catheter is boiled together with the lithotomy sling and douche bag. Both metal receptacle and glass tubes are first, however, scrubbed in a hot soda solution with soap and a brush. (6) The volsella, dressing, needle and tongue forceps, and scissors are, before being placed in the canvas case, simply scrubbed in hot soda solution with soap and a brush and then dried, as they are intended to be sterilized at the residence of the patient. (7) The obstetric forceps is treated in the same manner as the foregoing. (8) The sterile cotton, plain gauze, and iodoform gauze can be procured already sterilized from a dealer in surgical dressings.

(*b*) *In the canvas tray contained in the small female tray are:* (1) Green soap (sterile). (2) Vaseline (sterile). (3) Gauze eye sponges (sterile). (4) Gauze cord dressing (sterile). (5) Chloroform. (6) Ergot. (7) Strong acetic acid (99.5 per cent.). (8) Sublimate tablets. (9) Fine boric acid (sterile). (10) Normal saline powders. (11) Silver nitrate solution (2 per cent.). (12) Tape for cord (sterile). (13) Silk and gut ligatures and needles (sterile). (14) Soft-rubber catheter (sterile). (15) Umbilical scissors. (16) Medicine-dropper. (17) Nail-cleaner. (18) Safety razor. (19) English catheter (No. 16) with stylet. (20) Safety-pins. (21) Sterile gauze bandage for sling. (22) No. 8 soft braided catheter opening at end. (23) Spring scales.

Obstetric Operating Case.—For an operating set, add to the labor case the following: (1) Braun's cranioclast. (2) Dubois's scissors. (3) Smellie's perforator. (4) Three artery clamps. (5) Perineal retractor. (6) Tarnier forceps. The above six in canvas cases. (7) Scalpel and blunt bistoury. (8) Ether. (9) Rubber apron. (10) Sterile gauze bandages for slings.

*Use of the Case at the Bedside.**—It is recommended in the use of this obstetric case at the bedside that the leather cover be removed in another room or the hall, and only the enamel-ware trays carried into the lying-in room. A small table is selected, placed at the head of the bed on the side selected for vaginal examination and delivery. This table is covered with two or three freshly laundered towels. The large male case is lifted out of the smaller female tray and placed, with its contents undisturbed, at the distal end of the table (Fig. 610). The canvas tray is then lifted out of the small female tray and placed, with its lid thrown back, next to the large tray, and lastly and nearest the physician is placed the small female tray ready for the sublimate solution. If it is desirable to use the larger tray for hand washing, the articles contained in it may be arranged conveniently upon another portion of the table. Ordinarily I do not disturb the contents of the larger tray until needed, and use running tap-water for hand cleansing with soap and water.

The nail-cleaner, green soap, and one of the hand-brushes are now taken to the nearest tap of hot and cold water or to a basin of hot water, the coat is removed, the sleeves are rolled to the elbow, the nails are cleaned, and the hands and forearms are scrubbed and rinsed free of soap. Returning to the bedside, the clean gown is put on, the remaining hand-brush is dropped into a solution of 1 : 2000 sublimate in the smaller tray, and the hands and forearms are scrubbed in this. Sterile rubber gloves are now drawn on. The patient having been prepared for vaginal examination and confinement, these are carried out forthwith. As labor goes on, the various articles are taken from the canvas and large tray as

* My obstetric case is made for me by the Kny-Scheerer Co., 225 Fourth Avenue, New York.

needed. Sterile cotton and plain gauze are at hand as needed for sponges in any of the three stages; the Kelly pad for the rupture of the membranes or the second and third stages, or vaginal douches; the sterile douche bag and glass tubes for irrigation; the sterile vaseline for lubricating the fingers, if one desires to use it; chloroform for administration in the second stage; sterile gauze sponges to wipe the baby's eyes and mouth on the expulsion of the head; sterile tape to tie the cord; sterile dressing for the same; clean scissors to cut the same; nitrate of silver for the eyes; ergot for the end of the third stage or hemorrhage, as well as acetic acid for the latter, and a soft catheter to aspirate the baby's larynx. Should complications occur, we have the sterile lithotomy sling and the Kelly pad for drainage at the side of the bed; a safety razor to shave the vulva; a catheter to empty the bladder; a volsella and dressing forceps and iodoform gauze to pack the uterus; needle forceps, needles, scissors, silkworm-gut and catgut for lacerations of cervix or perineum; an English catheter to replace a prolapsed cord; a tube to give intrauterine irrigations, and sterile bandages to use as slings for versions.

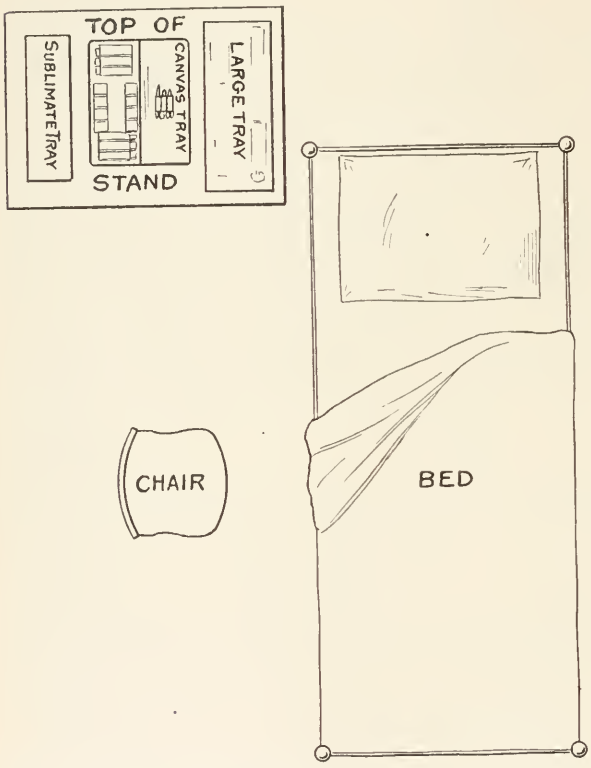

FIG. 610.—PLAN SHOWING ARRANGEMENT OF LYING-IN ROOM.

If major obstetric operations are demanded, we add to the above case the list of instruments already enumerated. If at any time in the course of labor the forceps, perineorrhaphy, or uterine packing set appears indicated, it is, in its original wrappings, placed in either the larger or smaller tray and sent to the kitchen to be baked or boiled.

5. THE OBSTETRIC NURSE. — She should be free from cutaneous, suppurative disease or purulent coryza, nor should she recently have attended cases of infectious diseases, especially erysipelas, scarlatina, diphtheria, or typhoid. Oral sepsis on the part of the obstetric nurse has heretofore received no attention, and may possibly account for otherwise inexplicable cases of puerperal infection. Two nurses, one for the mother and one for the infant, for at least the confinement and the first week of the puerperium, will generally secure a smoother and more rapid convalescence, and are strongly to be recommended. The obstetric nurse should early in the case learn the attending obstetrician's routine management of mother and infant, and should not depart from it unless serious emergency demand it. An excellent plan is for the physician to provide a printed résumé of his general treatment of the pregnant,

parturient, and puerperal woman, and have the nurse familiarize herself with the same.

6. The Lying-in Room.—The lying-in room should not have been used by any one suffering from infectious disease, and it should be of good size, well ventilated, and with as much sunlight as possible. Care should be taken as to the plumbing of the house, and the room should be as far removed from drains and water-closets as possible. It should be thoroughly cleaned and all unnecessary draperies and upholstered furniture removed. The temperature should range from 66° to 72° F. A bare floor is preferred to a carpeted one, but in case of the latter, the carpet may be protected by an oil-cloth or a rug at the side of the bed.

7. The Labor Bed.—The bed and bedding should be perfectly clean. The bed should be accessible from both sides and out of all draughts. It should not be too low. Soft beds should be avoided, a hair mattress being preferable. In all cases requiring operative interference it is much better to deliver the patient upon a table. Over the middle third of the mattress a piece of rubber sheeting, oil-cloth, or tarred paper, a yard or more in breadth, is placed and pinned firmly with safety-pins. A clean bed-sheet is then placed over the entire mattress and pinned down This is the permanent bed (Fig. 611). Over

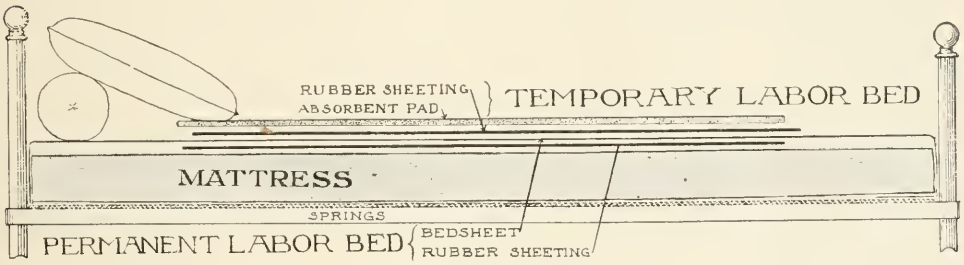

Fig. 611.—Plan of Arrangement of the Permanent and the Temporary Labor Beds.

the site of the permanent rubber sheeting, a second rubber sheet of the same size is placed. This is the foundation of the temporary bed, and is of the nature of a draw-sheet (Fig. 611). Upon this second rubber sheet may be placed one of the absorbent obstetric pads now commonly sold, or several sheets folded to retain the discharges from the vagina. During labor the absorbent pad may be renewed as necessary, and the last one, together with the upper rubber sheet, may be removed at the completion of labor. The permanent rubber sheeting remains for several days of the puerperium, to protect the mattress. A piece of oil-cloth or waxed cloth or a freshly laundered bath blanket should be placed at the bedside to protect the floor.

8. Articles to be in Readiness at Time of Labor.—(Obtainable in every household.) (1) Arrangement for an abundant supply of hot water. (2) A bowl for vomited matter. (3) Two clean earthen-, agate-, enamel,- or paper-ware bowls for hand cleansing. (4) A clean bowl for the placenta. (5) Three pitchers: one for boiling water, one for cold boiled water, and one for mixing antiseptic solutions. (6) A clean cup or tumbler with boric acid solution and gauze or old linen wipes for the baby's eyes. (7) A half-dozen freshly laundered old linen sheets to serve as bed pads or pilches. (8) An abundant supply of freshly laundered sheets and towels. (9) A change of night-clothing, warmed, for the

mother. (10) A warm blanket to receive the baby. Of these articles, the four bowls, the cup, and the three pitchers should be scrubbed with soap and water and boiled in a wash-boiler or at least scalded out. It is sufficient that the old sheets to be used as bed pads and the usual bed-sheets and towels be freshly laundered. For special cases, however,—for example, breech presentations,—it is desirable that half a dozen towels are sterilized by boiling or by dry heat in an oven, as described above.

FIG. 612.—WHITE LINEN SUIT FOR OBSTETRIC WORK.

Response to Summons.—A physician engaged to attend a case of confinement should, when summoned, respond as promptly as possible, since by the rigid observation of this rule it is frequently the case that complications which may easily be remedied at an early stage may present the gravest difficulties if not treated till a later period. Examples are malpresentation, malposition, faulty attitude, prolapse of the small parts, severe perineal laceration, postpartum hemorrhage, and fetal asphyxia.

Preparation of the Physician.—(See Asepsis in Obstetrics, page 148.)

Preparation of the Patient.—The pubic hair, especially when long or thick, should be clipped moderately short; then, whether the bowels have recently moved spontaneously or not, a full enema of soapsuds (Oij) and glycerin (one ounce) should be administered. After the onset of labor the use of the toilet by the patient should be forbidden in order to lessen the dangers of infection, and the commode or vessel must then be substituted. At this time and subsequently the patient should be encouraged to empty the bladder frequently and completely.

THE ANTE-PARTUM BATH.—The traditional ante-partum tub bath has recently * been the subject of severe criticism from the standpoint of asepsis. Not only is the parturient woman at the end of such a bath immersed in a dilution of her own dirt, but, as has been shown experimentally, the infected water often enters the vagina of both primiparæ and multiparæ. Moreover, under such conditions the danger of nipple infection is always present. The ideal ante-partum bath, then, would be for the patient to stand or sit under a running stream of boiled water, thus eliminating another possible source of septic infection of the parturient woman. This can, in maternity hospitals, readily be accomplished under a warm shower-bath and in some dwellings in private practice. When a shower of boiled water is not available, the author instructs the nurse to place the patient in a bath-tub and to pour several gallons of boiled water, allowed to cool to the proper temperature, over the shoulders of the patient, the patient at the same time being instructed

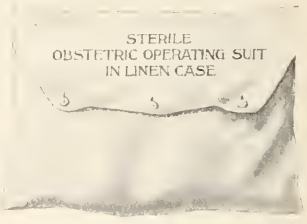

FIG. 613.—CASE CONTAINING LINEN SUIT FOR OBSTETRIC WORK.

* Sticher: "Centralblatt f. Gynäkologie," Mar. 2, 1901; and Strogan: "Centralblatt f. Gynäkologie," Feb. 9, 1901.

thoroughly to scrub the external genitals and body generally with a coarse, clean wash-cloth and green soap, the nurse using the soap on the back and shoulders. All soap is finally washed off and the bath completed with several quarts of sublimate solution (1 : 5000*). The patient's external genitals are finally thoroughly cleansed by the nurse with absorbent cotton and a 1 : 2000 solution of sublimate. The surface of the body is now dried with brisk friction. A sterile vulval pad as a temporary occlusion dressing is then applied and pinned to a waist-band made from a clean gauze bandage (Fig. 633). If a bath-tub is not available, the following procedure is recommended: (1) Have the patient take a sponge-bath of hot water and soap, using not a sponge but a clean wash-cloth. (2) The nurse is instructed to cut the pubic hair short, if it is long or thick, with scissors. (3) The nurse now with a soft hand-brush or absorbent cotton scrubs with soap and hot water the external genitals, pubes. and inner sides of the thighs, and cleanses the vulval canal from above downward with absorbent cotton and soap and water. (4) The parts are now rinsed off with clean water. (5) The same parts are then with absorbent cotton and 1 : 2000 sublimate solution given a final cleansing, always toward the anus, care being taken to include the vulval canal with the sublimate solution. A sterile vulval pad or gauze is now applied to the external genitals as a temporary occlusion dressing, and fastened by a T-bandage. In every method of cleansing the vulval canal and external genitals the greatest care must be used to avoid the production of erosions by stiff brushes or rough handling, as these lesions may subsequently become infected.

Ante-partum Vaginal Irrigation.—It now appears that the consensus of opinion of a few years ago as to the sterility and germicidal qualities of the vaginal mucus was somewhat premature. It is certain that the vagina in the healthy pregnant woman very often contains bacteria, often streptococci, and that in a majority of cases the germs enter the uterus immediately after delivery.

It is nowhere maintained that this phenomenon is inherently pathological; but it cannot be doubted that sometimes this is the case, and it is more than likely that these bacteria are responsible for the residual morbidity with occasional death which cannot be made to vanish with the strictest asepsis. This source of morbidity, if reached at all, may be reached only with ante-partum antisepsis.

The Examination of Labor.—The Obstetric Examination.—On entering the lying-in chamber the physician should note in a general way the physical and mental condition of the patient, and should she be, as is naturally in most instances the case, the victim of anxiety and nervousness, he should endeavor by his words and demeanor to reassure her and to quiet her apprehension. He should then take the pulse and temperature, not forgetting that the former is often increased by nervous influences, and, if time permits, a brief but careful examination of the heart and lungs is advisable, if this has not already been attended to (see page 148). In the obstetric examination it is advisable for the physician to follow some routine in order to avoid needless repetition and to secure thoroughness. (1) The patient has been prepared for labor as described on page 472. She is placed on a couch or bed in the dorsal posture, with the head but slightly raised, clothed only in her night-dress and covered by a sheet. (2) Unless such information has already been obtained at the examination during pregnancy, it is well at this point to record the age, parity, former health, especially children's diseases of the individual and at what

* Statistical proof from the Imperial Maternity Asylum of St. Petersburg shows a fall of 7.4 per cent. in fever in the puerperal woman by the substitution of the shower for the old-fashioned tub bath.

age she first walked; the type and date of her last menstruation; the history of her present pregnancy, and the character of her former pregnancies, labors, and puerperiums. The patient should be exposed as little as possible, hence for the external examination two sheets may be used, one to cover the body and one the lower extremities from the pubes down, the upper sheet being raised to expose the abdomen (Fig. 194). For the external examination in the dorsal posture, the patient may be covered with a sheet, as shown in Fig. 194. (4) The physician renders aseptic his hands and forearms as described on page 150, not forgetting that his coat should be removed and his forearm bared to the elbow. The woman physician should see to it that her sleeves are made so as to allow of their being rolled up. The use of sterile rubber gloves is to-day the best means for the prevention of infection.

External Examination.—Having attended to the foregoing preliminaries, it is now in order to make the external examination, and this should always, except in case of emergency, precede the internal, because: (1) It enables one to make the latter more intelligently; and (2) it helps one to gain the confidence of the patient and prepare her for the internal examination. This part of the examination, often neglected and usually undervalued, is of the highest importance. By many authorities it is considered almost equal in value to vaginal examination, while others who have made a careful study of this method claim that by its frequent use they can dispense altogether with the internal examination in a large proportion of cases. In the first stage of labor this examination will not differ greatly from the external examination already described under the "Examination of Pregnancy," page 150. Examinations should be made between the pains, since the action of the fetal heart is more rapid during a pain, and the uterine contractions render satisfactory palpation difficult. Although the diagnosis by external manipulation is somewhat more difficult at this time than before labor, it is usually possible to obtain a satisfactory idea of the position and presentation. Important facts to be noted are: (1) The position and presentation (see page 154); (2) the rate and character of the fetal heart-sounds (see page 129); (3) the condition of the bladder as to distention; (4) the size of the fetal head and whether or not it has entered or can be made to enter the pelvic cavity; (5) and the strength, duration, and frequency of the uterine contractions. The occurrence of the pains at regular intervals and the contraction of the uterus during a pain, which may be appreciated by a hand placed on the abdomen, are of importance in distinguishing the onset of true labor. The sinking of the uterus, referred to in the section on the symptoms and signs of pregnancy, which occurs during the last two weeks of pregnancy, is also of some significance. The characteristic shape of the abdomen when the membranes have ruptured and the head is low in the vagina soon becomes familiar to the observer and denotes that the patient is far advanced in labor.

Pelvimetry.—Should the patient be a primipara who has not been subjected to the examination of pregnancy (see page 150), the routine external pelvic measurements—namely, the crests, spines, trochanters, obliques, and external conjugate—should be taken, and if pelvic deformity exist, as further indicated by the internal examination, we should not hesitate to make a thorough internal examination under nitrous oxid or ether, passing the whole hand, if necessary, into the pelvis to secure accurate data of the available space at the pelvic inlet (see page 174). If the patient be a multipara, all these careful measurements in private practice are not necessary if the previous children have been of usual size and the labors uneventful.

Internal Examination.—After the external examination, the patient having already been prepared as described on page 472, the nurse should place

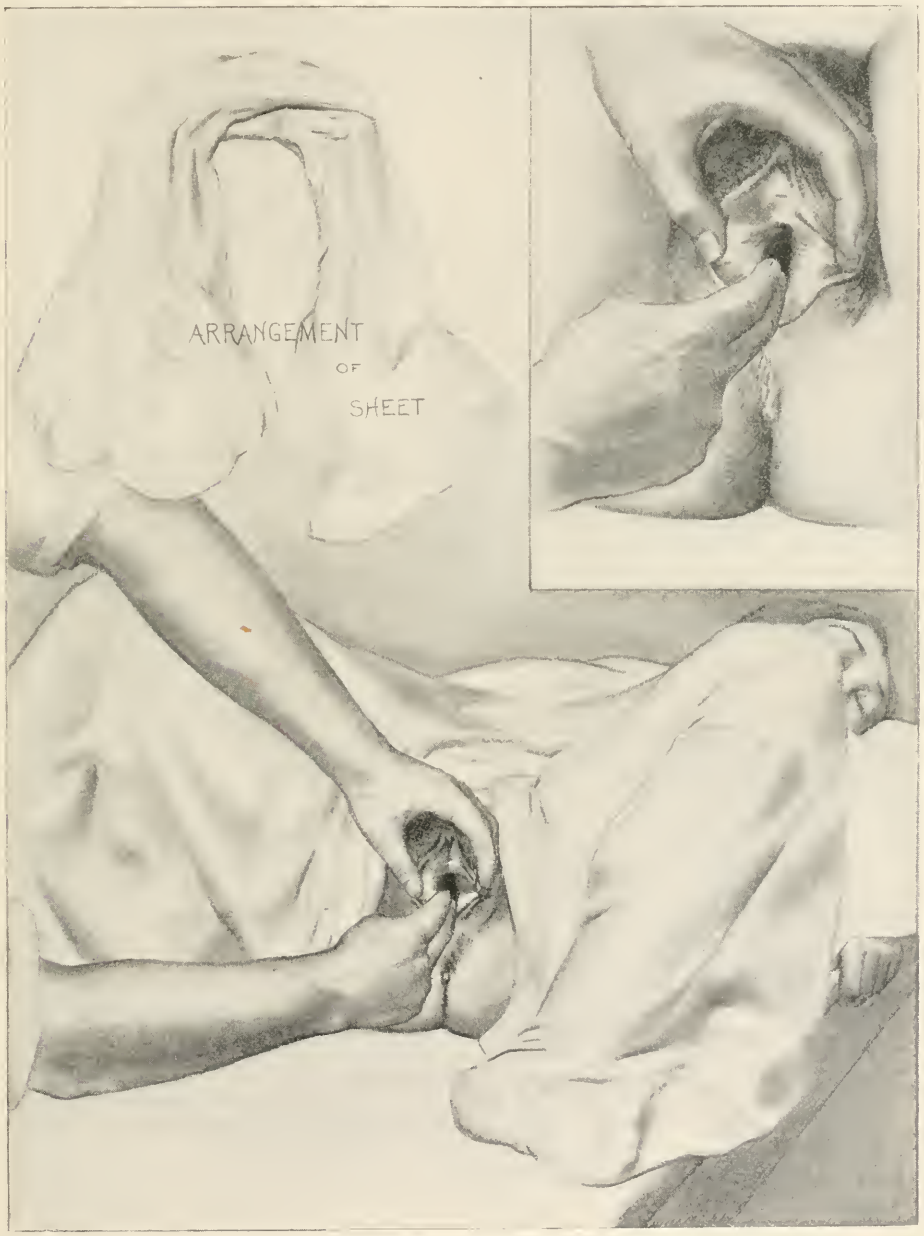

Fig. 614.—Vaginal Examinations during Labor. Position of the Patient and Separation of the Vulva; Introduction of the Fingers with the External Genitals Exposed to View. (Method recommended.)

her in the dorsal posture, with thighs flexed, parallel with the edge of the bed (Fig. 914). The external genitals and vulval canal are again cleansed from before backward by the nurse with 1 : 2000 sublimate solution by means of

absorbent cotton. No unsterilized object, hand, instrument, dressing, or clothing, should touch the genitals, which during the course of labor are covered with a sterile vulval pad. The physicians's hands and forearms are re-sterilized (see page 150) and the ostium vaginæ is exposed by separating the labia with the sterile thumb and finger of the left hand (Fig. 614). The sterile first and second fingers of the right hand are now passed directly into the vagina, having come in contact with nothing from the sublimate solution to the vaginal entrance (Fig. 614). No towel or vaseline should be used, the examination being made while the hand is still moist with the bichloride solution.

Fig. 615.—Vaginal Examinations during Labor. The External Genitals are not Exposed to View. (This method is not recommended.)

The First Vaginal Examination.—It is desirable to make a careful vaginal examintion as early as possible in the first stage in order to verify the information, as to the fetal position and presentation, which may have been obtained by external palpation, and to determine the existence or nonexistence of conditions in the pelvis or soft parts which would prove obstacles to delivery, unless the information has already been obtained at the examination during pregnancy (page 150). In the first vaginal examination during labor we should strive to determine: (1) The condition of the vulva and vagina as to dilatability and the presence of lubricating mucus; (2) the condition of the bladder and rectum; (3) the condition of the cervix as to dilatability and degree of dilatation; (4) is pregnancy present? (5) is the woman in labor? (6) what is the stage of labor? (7) the presence of the "bag of waters" and whether it becomes tense during a pain, an important point in distinguishing true from false labor pains; (8) the presentation and position; (9) the internal conjugate diameter; (10) any apparent disproportion between the presenting part and the capacity of the pelvis; (11) the effectiveness of the pains on the os, membranes, and presenting part. (12) This examination should also carefully confirm the results of the examination during pregnancy as to the presence of pelvic deformity or obstruction in the soft parts and as to the fetal position and presentation. If any suspicion of pelvic deformity exist, the true conjugate should be estimated, the height of the symphysis noted, the lateral

surfaces of the pelvis palpated, and the methods of determining the actual degree of pelvic deformity applied; these have already been described under the "Examination of Pregnancy," page 150. If the vertex presents and descends regularly with the pains, and if the patient's general and local condition is satisfactory, interference, and especially the passing of the finger through the os uteri, owing to increased danger of sepsis, is to be scrupulously avoided. Noticeable delay, however, in the progress of labor should be carefully investigated, and, if necessary, under anesthesia, as will be described in the section on delayed labor.

Repetition of Vaginal Examinations.—It was formerly the custom to make frequent examinations during the whole course of normal labor, and this is still taught in some text-books, but the consensus of modern teaching is to the effect that such a course is unnecessary and dangerous (see page 149). It is true that, with proper care as to asepsis, the danger of infection is limited, but it nevertheless exists, since even with the greatest care it is impossible to exclude all sources of contamination. Examinations are also annoying to the sensibilities of the patient, and when frequently repeated they sometimes become extremely painful. They tend to remove the vaginal mucus which nature has provided for lubricating the parts and to cause erosions of the mucous membranes which may serve as starting-points for septic infection. Their frequent repetition has in many cases a bad effect on the nervous system, and undoubtedly contributes at times reflexly to delay the progress of labor. It is nevertheless true that it is the duty of the attendant to keep himself informed of the progress of his patient, and that this may, at least in the case of beginners, require two or three vaginal examinations. Increasing experience diminishes the necessity for vaginal examinations, and it should be the effort of the physician to acquire such familiarity with abdominal palpation and the clinical history of labor that the necessity for frequent examinations may not exist.

Having made the first examination, the attendant should endeavor as far as possible to determine the further progress of labor by external palpation and by observation of the patient, but if in doubt, he should repeat the examination often enough to satisfy himself as to the non-existence of a delayed first stage. Exact rules as to the frequency of examination cannot be given, but modern investigation tends to the conclusion that in normal cases one careful examination early in the first stage and another after the rupture of the membranes should be sufficient for the experienced accoucheur. Examination after rupture of the membranes may guard one against the neglect of face presentation, which sometimes occurs at this time, and of prolapse of small parts of the fetus or of the cord; it determines also the exact position of the head. It cannot be too emphatically stated that pregnant, parturient, and puerperal women can be fatally infected by a single careless internal examination. Some danger of infection is always present, therefore internal examinations should be as infrequent as possible.

In many instances it is possible to conduct a labor without any internal examination, since the chief information gained through the vagina is the stage of dilatation of the cervix, and this is often not specially important to know. Leopold and Sporling * and Leopold and Orb † believe that it is possible to conduct safely 90 per cent. of all labors without any other than external methods of examination. Among the first 1000 cases of these observers there were only 6.5 per cent. of errors of diagnosis, while in the second thousand the percentage was only 1.77 per cent.

* "Arch. für Gyn.," xlv, 339–371.

† "Arch. für Gyn.," xlviii, 304–323.

MANAGEMENT OF THE FIRST STAGE.

This stage commences with the onset of true labor pains and ends with the full dilatation or dilatability of the os uteri. The conduct of the obstetrician during this stage is usually passive, provided no evidences of maternal or fetal dystocia have been discovered at the examination either during pregnancy or during labor.

Posture of the Patient.—In the absence of any abnormal conditions, such as hemorrhage, placenta prævia, or prolapse of the funis, the patient may follow pretty much her own inclinations as regards sitting up, walking about, or lying down. In prolonged labor, especially in primiparæ, sitting erect or walking about the room is of advantage in assisting dilatation of the os and fixation of the head. As soon, however, as the os is nearly dilated or dilatable, and the membranes are about to rupture, the patient must be placed in the dorsal or lateral recumbent position, until the membranes rupture or are ruptured artificially. Should rupture occur when the patient is in the erect posture, there is danger of prolapse of the cord or of one of the fetal extremities.

Presence of the Physician.—His presence in the lying-in room is not usually advisable at this time, but in multiparæ and in rapidly progressing labors in primiparæ it is best that he be within call.

Vaginal Examination.—Repetition of the examination during labor (page 149) is usually not necessary, although many advise an immediate examination when the membranes rupture so as to exclude prolapse of the funis. Frequent abdominal palpation will generally suffice for following the progress of labor (see page 154).

Food, Drink, Sleep, Attention to Bladder and Rectum.—In prolonged labors the patient should be encouraged to take at intervals during the first stage small quantities of liquid nourishment, such as plain milk or milk and carbonic water, or simple broths or soups, such as chicken, clam, or beef. I am accustomed to forbid the use of solid food, in view of the fact that ether or chloroform narcosis may subsequently be demanded. No restriction should be placed on the amount of water desired by the patient. When there is nausea or vomiting, very hot clear tea or black coffee can advantageously replace the water. In the absence of a positive indication alcohol should be avoided. The patient should be induced and aided to sleep, if possible, between the pains, especially if labor commences at night, since a sleepless night is a bad preparation for labor. The patient should empty the bladder at frequent intervals, since its distention is a common cause of delay at this time. The catheter should be avoided. If the rectum has not already been emptied, or if it refills again, a copious enema should be given.

Use of the Voluntary Forces.—In any but exceptional cases voluntary bearing-down efforts on the part of the patient, either with or without the aid of bandages of bed-sheets used as traction straps for the hands, should be discouraged. Such proceedings only fatigue the patient and usually do not aid the progress of labor.

Care of Membranes.—Every precaution should be taken against the accidental rupture of the membranes, either by vaginal examination or by sudden movements of the patient, in order to avoid a dry labor and its consequences (see Part V).

Anesthesia.—(See Operations, Part X.)

MANAGEMENT OF THE SECOND STAGE.

This stage commences with full dilatation or full dilatability of the os, and ends with the complete expulsion of the fetus or fetuses.

Posture of the Patient.—At or near the end of the first stage the patient should be placed in bed, and, as a rule, must remain there until the completion of the second stage, the bed-pan being used for evacuations of the bladder and bowels. As the period of fetal expulsion approaches, the patient is placed in the position, dorsal or lateral, preferred by the physician, and the nurse is instructed to draw up and pin at the shoulders the night-clothing to protect it from soiling. An ordinary bed-sheet may be pinned about the waist like a skirt to cover the lower part of the body and as a further protection against soiling.

Presence of the Physician.—Usually he should not absent himself during this time.

Vaginal Examination.—In the absence of dystocia, abdominal palpation may be relied upon for determining the course of labor (page 154).

Food, Drink, Sleep, Attention to Bladder and Rectum.—The same principles apply here as in the first stage, with the exception of sleep (page 478). The second stage is usually so short that it is rarely necessary to feed the patient. Care should be taken, however, that both bladder and rectum are empty at this time. The presence of a distended bladder can be determined by external examination.

Use of Voluntary Forces.—In the second stage, and especially when it is protracted, the patient should be encouraged to bear down during the pains. Much can be accomplished by instructing the woman to hold her breath and bear down as a contraction reaches its height. If the contractions are severe and painful and the patient does not bear them well, she may be induced to bear down by being allowed to inhale a few drops of ether or chloroform at the beginning of each pain. Other legitimate and simple measures to overcome inefficient contractions at this time are having the patient repeatedly assume a sitting posture on the edge of the bed, or even on a chair; pulling upon the hands of the nurse; bracing the feet against the foot of the bed; pulling with both hands upon slings made of stout roller bandages fastened to the bed below the feet. (See Prolonged Labor.) For a too rapid expulsion anesthesia is our sheet-anchor; instructing the patient not to bear down is also useful.

Artificial Rupture of the Membranes.—The membranes usually rupture spontaneously at or near the completion of the second stage after their purpose has been accomplished. Earlier rupture is not uncommon. A common and pernicious practice is the early artificial rupture of the membranes to accelerate labor. As a rule, they should not be interfered with, even though they distend the vulva. Indications may arise which demand their artificial rupture. (See Operations, Part X.)

Anesthesia.—(See Operations, Part X.)

Perineal Protection.*—When the presenting part approaches the pelvic floor and vulva, preparations are to be made to protect the perineum from rupture. The most important part of the management of the second stage is the prevention of perineal tears. Lacerations of the fourchette in primiparæ and superficial tears about the vulval orifice often occur, but these readily heal

* For the varieties, frequency, etiology, mechanism, symptoms, diagnosis, prognosis, and prophylaxis of perineal injuries, see Pathological Labor, Part V. For the treatment of the same, consult the section on Obstetric Surgery, Part X.

with simple asepsis. Deep tears, however, are avoidable in normal cases. The great importance of avoiding rupture of the perineum cannot be overestimated. It is scarcely an exaggeration to state that one-half of the gynecological cases owe their condition directly or indirectly to rupture of the muscles of the pelvic floor during labor. The causes of perineal laceration are three in number, namely: (1) Relative disproportion in size between the presenting part and the pelvic outlet; (2) too rapid expulsion, so that tearing instead of stretching results; (3) and faulty mechanism of labor whereby a larger circumference of the presenting part than necessary passes through the outlet.

Prophylaxis depends upon the cause.* If there is great disproportion in size or abnormal rigidity of the outlet, abundance of time must be given to the muscles of the pelvic floor to stretch sufficiently without tearing to permit of the passage of the fetus. Preliminary digital stretching as well as the use of chloroform will assist in the relaxation of these muscles, and if all attempts fail and conditions do not permit of further delay, episiotomy, properly performed and repaired, is preferable to deep perineal rupture (see Obstetric Operations, Part X). The chief ends in view are (1) to prevent too rapid expulsion; (2) to preserve the normal mechanism of delivery, and, if possible, (3) to effect delivery of the head between the pains.

1. *The too rapid advance of the head* can be prevented by inducing the patient to refrain from bearing-down efforts, to breathe rapidly during the pains, and to cry out during the emergence of the head; by the manual retardation of the presenting part and by the administration of chloroform or ether. Partial anesthesia is an invaluable resource, aiding relaxation of the tissues, preventing too rapid expulsion, and allowing of complete control of the case. The advance of the head should be retarded by pressure applied not to the perineum but to the presenting part. No attempt should ever be made to support the perineum directly, and all methods of perineal protection which depend upon intrarectal manipulations of any character should be carefully avoided, as liable to injure the rectum, produce spasm of the pelvic floor muscles, and favor subsequent infection of the genital tract or the eyes or umbilicus of the child.

2. *The normal mechanism of delivery* should be aimed at so as to secure the smallest possible diameters of the presenting part to pass through the parturient outlet. A valuable point in vertex anterior positions is so to retard extension of the head, until the external occipital protuberance has passed the subpubic ligament, that the smallest or suboccipito-bregmatic circumference (Fig. 574) may be the one to engage and pass through the outlet.

3. *Delivery of the head between the uterine contractions* has a distinct advantage in that we have a relaxed instead of a rigidly contracted pelvic floor to deal with. Method second or third will accomplish this end.

Methods of Perineal Protection.—Any of the various postures of the patient may be selected, but I advise the left lateral prone posture for left positions of the presenting part, and the right lateral prone posture for right positions. It is generally admitted that the lateral position is most favorable to perineal preservation. In this position the force of violent pains is diminished, since the expulsive power here is actually a resultant of two divergent forces. In the lateral and latero-prone positions the intra-abdominal pressure is also weakened, and the perineum is always under ocular control. Further, disinfection may be carried out more completely in the lateral decubitus. In the dorsal posture the weight of the head carries the latter away from the pubic arch and against the perineum; this condition is not favorable to the latter. While this disadvantage

* Compare Pathological Labor, Part V.

may be offset by the upward pressure of the anterior segment of the perineum toward the symphysis, the former thereby becomes ischemic, thin, and more prone

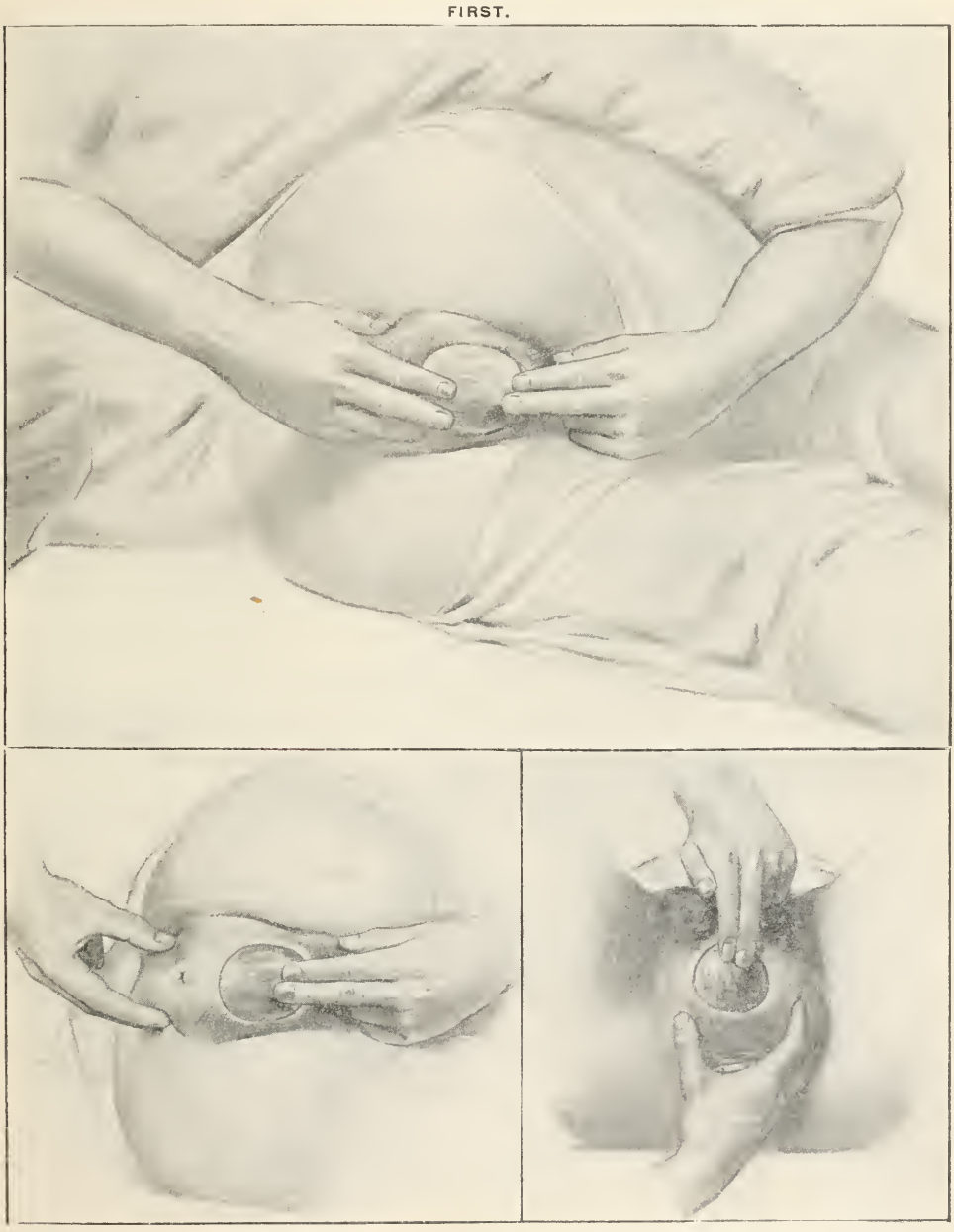

FIG. 616.—PERINEAL PROTECTION, SHOWING THREE METHODS.

to rupture. The thighs, however, should not be too energetically flexed, otherwise the perineum will be put upon a dangerous stretch. After delivery the lateral posture must be quickly changed to the dorsal, lest air embolus result. Among

primitive people a squatting or kneeling position is often instinctively adopted during delivery, but it cannot be claimed that such postures favor the perineum, as labor under these circumstances has a precipitate character. While labor may be shortened and facilitated by these attitudes, the safety of the perineum would seem to demand that the lateral position should be assumed during the moment of expulsion. Any of the following methods may be utilized, as all are subservient to the principles already laid down. The principle in all methods of direct manual protection of the perineum is to delay expulsion of the presenting part in such manner as to realize all the advantages of the elasticity of the perineum. The degree of latent elasticity of this structure may be determined by inspection. The fetal head, or other presenting part, should be supported rather than the perineum. In fact, the attempt to support the latter is attended by danger.

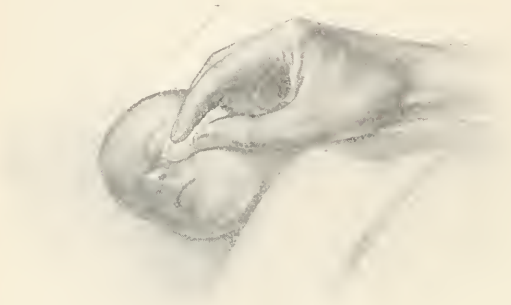

FIG. 617.—CLEANSING THE EYELIDS IMMEDIATELY AFTER THE BIRTH OF THE HEAD.

Method one: The patient is placed in the lateral prone posture. In the left lateral prone posture the physician, seated at the bedside behind the patient, passes the left hand and forearm over the right thigh of the patient and uses the fingers of this hand to retard the exit of the presenting part, and also to assist, to a small extent, the normal mechanism of labor until the pelvic floor is sufficiently stretched to allow the passage of the fetus without laceration (Fig. 616). At the same time, with two or three fingers of the right hand placed upon the protruding head, and without touching any part of the maternal tissues, control of the expulsion and regulation of the head movements can readily be carried out (Fig. 616). In this method both hands are used to control a too rapid advance and conjointly to regulate the head movements, so as to secure the most favorable mechanism of head delivery. Chloroform or ether will greatly assist our endeavors

FIG. 618.—LITTLE FINGER WRAPPED WITH GAUZE FOR REMOVING MUCUS FROM THE CHILD'S MOUTH.

Method two: The posture of the patient and the position of the physician are the same as in Method One. Chloroform or ether is invaluable. The position and functions of the left hand are the same as above. At the same time, with the fingers of the right hand (Fig. 616) placed on each side of the coccyx, over the extremities of the bitemporal diameter of the fetal head, the presenting part is pushed up as close to the subpubic ligament as possible, thus making use of all the available space of the pubic arch. The use of chloroform or ether to the obstetric degree, and the delivery of the presenting part during perineal relaxation between the pains, by pressure with the fingers on either side of the coccyx, or by *expressio fœtus* (Part X), will greatly lessen the chances of rupture. Exten-

sion and delivery of the head should never be permitted until the external occipital protuberance has been born beyond the arch of the pubes.

Method three: Lateral posture and chloroform or ether, as above. In the left lateral posture the right, and in the right posture the left, hand is used for perineal protection. In the dorsal posture of the patient either hand is available. By the natural forces or by pressure upon the fundus the head is made to distend the vulva sufficiently to enable the middle finger of the perineal hand to obtain a point of pressure upon the forehead of the fetus by reaching behind the anus but without entering the rectum (Fig. 616). The thumb of the hand is then placed upon one labium majus and the index-finger upon the other over the parietal protuberances of the advancing

FIG. 619.—METHOD OF LOOSENING AND CARRYING THE CORD OVER THE HEAD WHEN THE FORMER IS TIGHTLY COILED ABOUT THE CHILD'S NECK.

FIG. 620.—METHOD OF SHOULDER DELIVERY. THE HEAD IS RAISED TO BRING THE NECK CLOSE TO THE PUBES, AND THE ANTERIOR SHOULDER WELL BEHIND THE SYMPHYSIS, THUS ENCOURAGING DELIVERY OF THE POSTERIOR SHOULDER FIRST, WITH THE CERVICO-ACROMIAL DIAMETER ENGAGING.

head (Fig. 616), and serve to draw the labia inward and backward and prevent undue strain upon the posterior commissure, which lies in plain sight above the

FIG. 621.—METHOD OF SHOULDER DELIVERY. THE ANTERIOR SHOULDER IS HERE BORN FIRST, AND THE HEAD IS RAISED TO ENCOURAGE EXPULSION OF THE POSTERIOR SHOULDER.

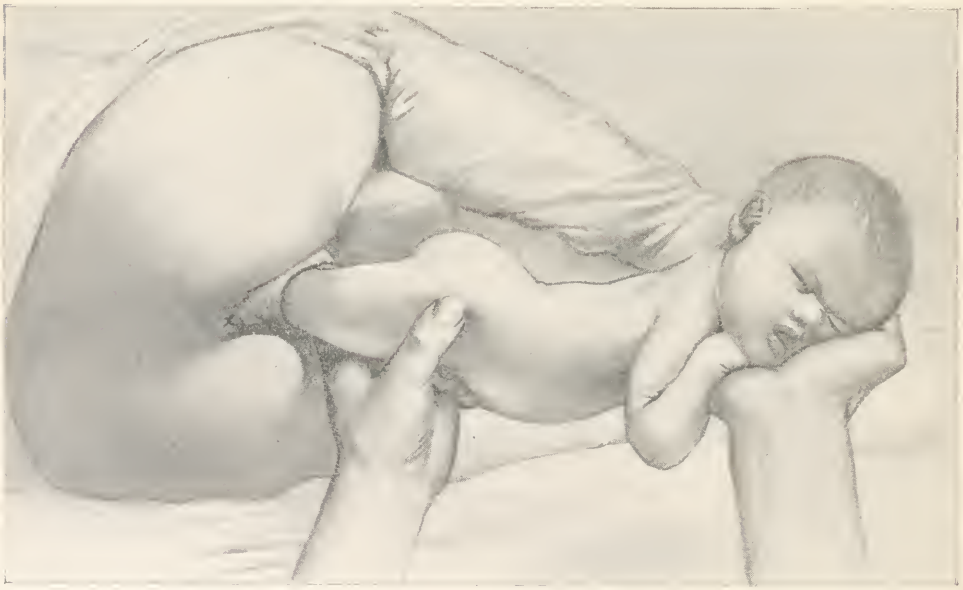

FIG. 622.—SUPPORTING THE CHILD DURING THE EXPULSION OF THE TRUNK AND LEGS. Note that the trunk is grasped at the pelvis, leaving the chest and abdomen free from pressure.

web between the thumb and forefinger. Pressure of the fingers upon the parietal eminences prevents the too sudden advance of the head, while the middle finger

FIG. 623.—PROPER POSITION OF THE CHILD IMMEDIATELY AFTER DELIVERY. It lies on its right side and the buttocks are raised to favor the flow of mucus and foreign substances from the mouth.—(*From a photograph taken at the Emergency Hospital.*)

reaching behind the anus and protected by a sterile towel exerts pressure upon the forehead, and at the proper moment during the relaxation between the pains increases head extension and slowly shells it out through the vulval opening. Moderate fundal pressure with the free hand may assist in the manœuver.

Cleansing of Eyes and Mouth.—After the delivery of the head, the eyelids should be carefully cleaned by means of a soft linen cloth and sterile water, or boric acid solution; a separate wipe being used for each eye and the lids washed, from the nose outward, free from all mucus, blood, or meconium. At this time also the lips and nose are in like

FIG. 624.—METHOD OF "STRIPPING" THE UMBILICAL CORD TO REMOVE THE EXCESS OF WHARTON'S JELLY.

manner wiped free of mucus, and the little finger, wrapped with a piece of moist linen, is passed into the child's mouth and any accumulated mucus removed by an outward sweep of the finger (Fig. 618).

Care of the Cord about Neck.—Search should be made to discover whether the cord encircles the neck, and if it does a loop should be enlarged and drawn over the head; but if this cannot be done, the funis should be cut between a double ligature, or, if time is lacking, without the application of ligatures (Fig. 619).

FIG. 625.—METHOD OF TIGHTENING THE LIGATURE ABOUT THE UMBILICAL CORD. Note the position of the thumbs to prevent injury to the ring from cutting or breaking of the ligature.

Delivery of the Shoulders.—After the head is born, in the absence of any indication for immediate delivery, it is better to wait for natural expulsion of the shoulders and body, the head in the mean time being supported in the flat of the hand (Fig. 620).

Preservation of Perineum during Delivery of Shoulders.—This is best attained by preserving the normal mechanism of shoulder delivery (see page 447). Delivery of the shoulders should be delayed if possible until nearly complete rotation of the bisacromial diameter has taken place. The head should be held in the hand and gently raised so as to bring the anterior shoulder well up behind the symphysis, thus securing the cervico-acromial diameter of the fetus at the outlet instead of the bisacromial (Fig. 620) The posterior shoulder is thus permitted to be delivered first, contrary to the common custom, and should be carefully guided in its passage over the perineum. Shoulder delivery should be accomplished whenever possible by the natural forces, since I have found that manual extraction increases the number of perineal lacerations. Care should be taken lest during the delivery of the shoulders an existing laceration caused by the head be increased in size. During the detention of the anterior shoulder behind the pubis the fetal hand of the opposite arm lying across the child's chest will usually soon appear in the vulva. Delivery, we have found, is assisted by slowly flexing this forearm and arm out through the vulva and thus delivering the posterior shoulder by slight traction on the posterior arm. Should there be delay in the expulsion of the posterior shoulder, traction upward upon the head, the fingers encircling the neck, is to be preferred to traction with a

FIG. 626.—METHOD OF CUTTING THE UMBILICAL CORD AFTER THE APPLICATION OF THE TWO LIGATURES.

finger in the axilla. (See Part X.) Should there be delay in the delivery of the anterior shoulder, it is best remedied by making traction directly downward

FIG. 627.—METHOD OF INSPECTING THE STUMP OF THE UMBILICAL CORD FOR HEMORRHAGE.

FIG. 628.—METHOD OF INSTILLING DROPS OF NITRATE OF SILVER SOLUTION INTO THE EYE OF THE NEWLY BORN CHILD.

FIG. 629.—METHOD OF LIFTING THE NEWLY BORN CHILD WITH ONE HAND.—(*From a photograph taken at the Emergency Hospital.*)

with the hands placed on the sides of the head, taking care not to injure the perineum. If this does not succeed, traction may be made by a finger in the axilla. (See Part X.)

Delivery of Body, Pressure on Fundus.—After delivery of the shoulders the body is, as a rule, rapidly expelled. Should there be delay, however, the thorax may be grasped with the hands and gentle traction made, or, better, the fetus expelled by pressure upon the fundus. In the delivery of the shoulders and body of the fetus the general principle—namely, to make use of all the available space of the pubic arch—is followed. To accomplish this, the shoulders and body are not permitted to press too closely against the perineum, but are rather pushed carefully into the pubic arch. During the expulsion of the fetus the fundus is followed down by the hand of the physician or assistant, and must be watched for at least an hour. This duty may be relegated to an assistant or a nurse.

FIG. 630.—METHOD OF LIFTING THE NEWLY BORN CHILD WITH TWO HANDS.—(*From a photograph taken at the Emergency Hospital.*)

Care and Posture of the Child in Bed.—If the child cries vigorously, measures for establishing respiration are unnecessary, and all rough handling should be avoided. It should be wrapped in a warm blanket previously prepared and allowed to rest between the mother's thighs until after ligation of the cord (Fig. 623). It should be placed upon the right side, since this posture tends to aid the physiological changes in the fetal circulation, and with head low to prevent cerebral anemia.

Establishment of Respiration.—Should the child cry out feebly, or should there be any delay in the establishment of respiration, it should be smartly slapped upon the buttocks or a few drops of cold water should be dashed upon the face and chest. In feeble or premature children, however, all rough handling should be avoided. (See Asphyxia Neonatorum, Part IX.)

Ligation of the Cord.—Respiration being fully established, the ligation of

the cord should be delayed until pulsations cease, unless there is some positive indication to the contrary. Immediate ligation deprives the fetus of about three ounces of blood. Before ligation it is a good plan to grasp the cord with the thumb and first finger of one hand close to the navel, care being taken not to make traction, and with the fingers of the free hand to strip away the gelatin of Wharton from the fetus for a distance of two or three inches (Fig. 624). This gives a thin stump for subsequent separation. The cord is now ligated with sterile bobbin or floss silk, about 1¼ inches from the umbilicus, it being first determined that no lesion of the cord exists. A second ligature is then placed about two inches from the first in order to prevent hemorrhage in case of twins, but chiefly to retain blood in the placenta that the uterus may more readily expel it. Division of the cord with scissors is now performed close to the first ligature.

FIG. 631.—METHOD OF INSPECTING THE LOWER VAGINA AND PERINEUM FOR LACERATIONS AT THE COMPLETION OF LABOR.

FIG. 632.—TESTING THE AMOUNT OF INJURY TO THE PERINEUM.

This is best done in the hollow of the hand, the scissors being passed between the second and third fingers to avoid injury to the actively moving extremities and unnecessary spurting of blood (Fig. 626). Some amputate the cord close to the

umbilicus and bring the edges together with fine sutures (Dickinson). I have been unable to determine that this procedure possesses any advantages over the ordinary method. The stump of the cord is now touched with sublimate solution (1 : 2000) and a dry occlusion dressing of absorbent cotton or gauze is applied (Fig. 627).

Care of Child.—The child, wrapped in some warm material, is placed upon its right side with its head lower than its body in some safe spot where it will not be liable to fall to the floor or be sat upon. In lifting a naked, slippery child from the bed to wrap it in a blanket one may grasp it as in Fig. 629 by one hand, or with two hands, as in Fig. 630. In both instances the head in a state of flexion should be allowed to hang lower than the body. Either of these methods is recommended for physiological reasons.

Prevention of Ophthalmia.—As soon after birth as convenient the eyes and lids are again wiped clear of mucus and 2 drops of a 2 per cent. solution of nitrate of silver are dropped into each eye (Fig. 628). This is strongly advised both in private and hospital practice.

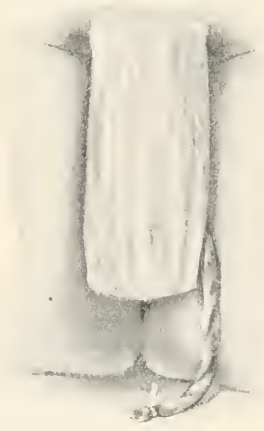

FIG. 633.—TEMPORARY VULVAL DRESSING OF STERILE GAUZE DURING THE THIRD STAGE OF LABOR.

Inspection of Perineum (Fig. 631).—Immediately after the completion of the second stage the patient should be carefully turned over from the lateral to the dorsal posture to avoid air embolus I am accustomed to inspect the perineum at this time instead of waiting for the completion of the third stage. My reason for this is that it can be more readily done now on account of the partial anesthesia of the second stage. The perineum and vagina should be carefully examined, as many severe lacerations are not visible externally. The labia are separated by the fingers wrapped in sterile gauze or cotton, both hands being used, and the parts thoroughly inspected. Here as elsewhere, however, intra-rectal manipulations are to be avoided if possible. The occurrence of rather free hemorrhage during the latter part of the second stage may indicate a vaginal laceration.

Preliminary Vulval Dressing (Fig. 633).—Immediately after the expulsion of the child, I am accustomed to place over the gaping vulva an antiseptic dressing, either several folds of aseptic gauze or one of the aseptic vulval pads in common use. This dressing is allowed to remain *in situ* until the placenta displaces it on the delivery of the latter. This dressing I use with two objects in view: first, to prevent, as far as possible, the entrance of air into the gaping vagina; and, second, to indicate the amount of hemorrhage going on at this period.

MANAGEMENT OF THE THIRD STAGE OF LABOR.

The third stage of labor commences at the complete expulsion of the fetus or fetuses and ends at the complete expulsion of the placenta and membranes. The patient having been carefully assisted in turning from the lateral to the dorsal posture, the physician or nurse continues by gentle pressure, not kneading, of the fundus to keep up and encourage firm tonic uterine contractions in order to prevent hemorrhage and the formation of an intrauterine clot. When the uterus does

not seem to be doing its work properly, it may be necessary to use gentle friction by a circular motion with the hand until contractions are resumed, or it may even be necessary to grasp the fundus vigorously and subject it to active manipulation in order to get a prompt response. There is generally a tendency to hasten the completion of the third stage. This should be avoided, and the temporary suspension of strong uterine contractions after the expulsion of the child should be looked upon as a physiological condition. Common mistakes at this time are: (1) Undue haste and rough manipulation in the completion of the third stage. This is a common cause of retained placenta. (2) Premature attempts at expulsion. It should be delayed at least until about half an hour after the birth of the fetus unless previous separation occurs. (3) The neglect to assure one's self that the bladder is empty. (4) To press the uterus forward against the pubis instead of downward and backward, more in the axis of the pelvic outlet. (5) To excite contractions instead of waiting for the natural ones. The former method should be practised only in cases of hemorrhage or dangerous uterine inertia. (6) It is not necessary to twist the membranes into a rope, and sometimes they are torn in this way. If the membranes should tear, a piece of sterilized thread may be tied to the part projecting from the cervix Traction upon the membranes should not be made.

With the onset of the third stage of labor care as to asepsis should be redoubled. Untold harm has been done by unnecessary interference at this time, and sepsis is often caused by irrational attempts at its prevention. After the second stage the vagina and cervix are full of abrasions and trifling lacerations which are of no consequence if let alone, but which offer a tempting field for the propagation of septic germs. In normal cases all manipulations within the vagina, and especially the introduction of the fingers, should be scrupulously avoided during and after the third stage of labor.

Prevention of Hemorrhage and Delivery of Placenta and Membranes.—The chief objects at this time are (1) to secure good uterine contraction, (2) to prevent hemorrhage and to deliver the placenta and membranes intact. If, as frequently happens, the placenta follows the child into the vagina, it may be expressed at any time. Usually, however, placental separation takes at least half an hour. For this period after the child is delivered the uterus should be kept under manual observation, and if the placenta and membranes are not expelled in that time, the Credé method may be resorted to (Figs. 634 and 635).

Credé's Method of Placental Expression.—To practise this the fundus is grasped with one hand, fingers behind and thumb in front, and a contraction awaited (Fig. 636). At the height of the pain the uterus is firmly compressed and forced downward and backward into the pelvis. If the first attempt fail, another may be made in the same manner at the next contraction. It may be necessary to repeat this procedure during several contractions. When the placenta appears at the vulva, little or no traction must be made upon it, but the membranes loosened and expelled by compression of the fundus of the uterus. at the same time pushing the uterus backward as nearly into the axis of the vagina as possible; the placenta meanwhile is allowed to rest in the palm of the other hand so that no unnecessary traction shall be made on the membranes (Fig. 635). The last string of membrane should be rather squeezed out than drawn out. After delivery of the placenta and membranes the physician continues to hold the fundus in the hand; this should be done for an hour after delivery (Fig. 334). An assistant or a nurse may relieve the physician of this duty. (See Operations, Part X.)

Examination of the Placenta and Membranes (Fig. 637).—The physician now

takes the placenta, turns the membranes back, and places the fetal surface down on the palm of his hand. The cotyledons should lie in close apposition; there should be no defect on the uterine surface at the furrows limiting the cotyledons, or at the margin of the placenta; the grayish-white coating of the decidua serotina should cover the cotyledons and no red placental villous tissue should be seen. He examines the margin of the placenta for torn vessels pointing to the retention of the secondary placenta or placenta succenturiata. Then he passes the hand into the cavity of the membranes, distends them, and, taking into account the

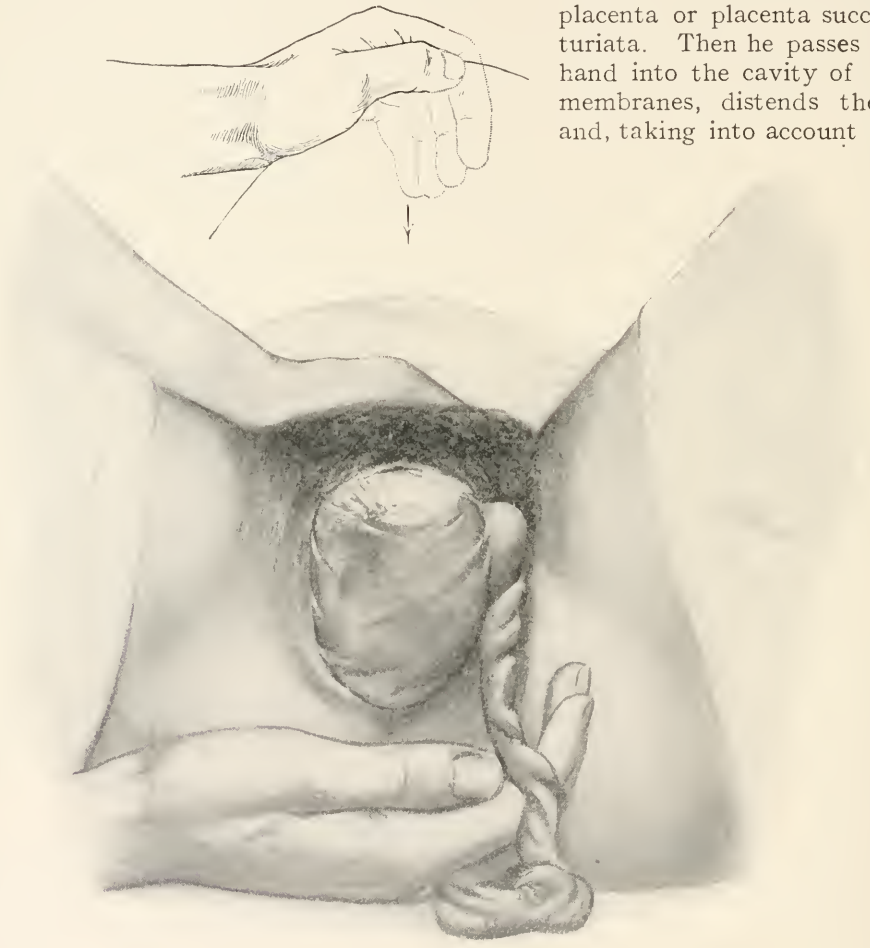

FIG. 634.—DELIVERY OF THE PLACENTA. THE LEFT HAND FOLLOWS DOWN THE FUNDUS OF THE UTERUS AND THE RIGHT HAND RECEIVES THE PLACENTA, THE LATTER PREVENTING ANY SUDDEN TENSION UPON THE AFTER-COMING MEMBRANES. The placenta is here expelled by Schultze's mechanism.—(*From a photograph taken at the Emergency Hospital.*)

size of the child and the amount of liquor amnii, estimates as nearly as possible whether the entire bag of membranes be present.

Retention of Secundines.—Retained fragments of placenta are best removed immediately by passing two fingers into the vagina and os uteri, and with the external hand pressing the fundus down over the internal fingers which grasp and remove the fragments. Dangers of subsequent hemorrhage and sapremic infection are thus avoided. When uncertainty exists regarding the retention of

small pieces of membrane, one can safely adopt an expectant plan of treatment, as in this case it is safer than intrauterine manipulations. The proposed routine uterine and vaginal examinations of the genital tract at this time to determine the condition of the parts and the retention of secundines cannot be too vigorously condemned. Nothing is to be gained by this course save in very exceptional cases, and as its routine practice involves a distinct element of risk, its adoption cannot be recommended.

FIG. 635.—DELIVERY OF THE PLACENTA. THE DELIVERED PLACENTA IS SUPPORTED IN THE RIGHT HAND AND THE LEFT HAND MAKES MODERATE PRESSURE UPON THE FUNDUS OF THE UTERUS UNTIL THE MEMBRANES ARE LOOSENED AND EXPELLED.—(*From a photograph taken at the Emergency Hospital.*)

Repair of the Perineum.—Lacerations of the vagina and perineum should now be carefully closed with appropriate sutures. (See Part X.)

Ergot.—If the retraction of the uterus should not be entirely satisfactory after it is emptied, and manipulations and the Credé method have not induced contractions, fluid extract of ergot may be given by the mouth or subcutaneously. The usual dose is one-half to one drachm by the mouth and twenty minims hypodermically; it may be repeated if required. This drug is especially useful after chloroform anesthesia, since the uterus sometimes does not contract quite promptly after its employment. Ergot used after the uterus is empty is useful as a preventive not only of hemorrhage, especially in multiparæ and atonic cases,

but of sepsis, and as an aid to involution and in the prevention of after-pains. The contraction of the uterine muscle keeps the sinuses closed, preventing the

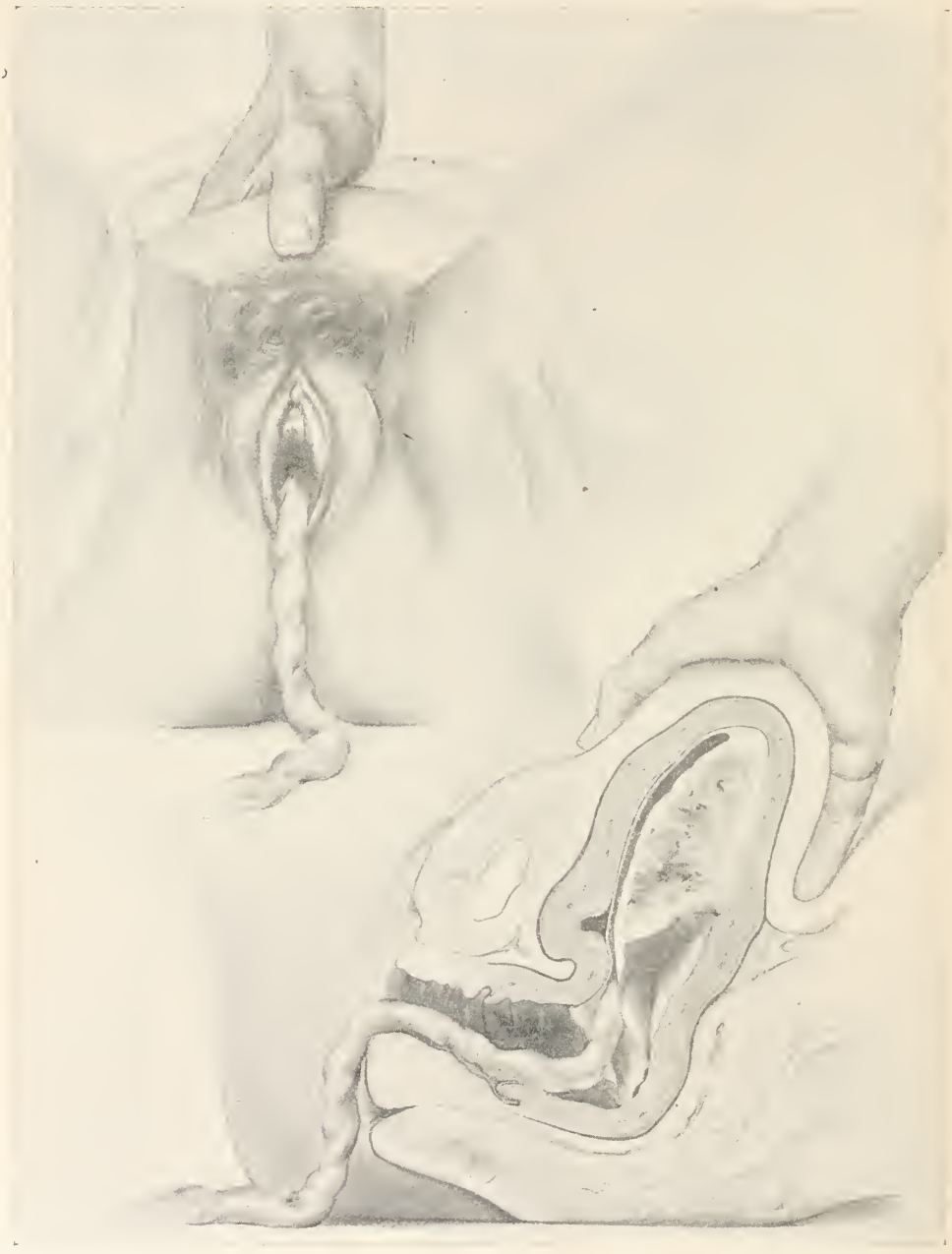

FIG. 636.—CREDÉ'S METHOD OF PLACENTAL EXPRESSION.—(*The upper illustration is from a photograph taken at the Emergency Hospital.*)

formation of clots and the entrance of sepsis, and also hastens involution by curtailing the blood-supply to the uterine muscular tissue. On the one hand, I

know of no valid objection to the use of one or two doses of ergot after confinement; and, on the other, the drug thus used adds materially to the safety and comfort of the patient.

Post-partum Douche.—There is at present some controversy as to the advisability of giving a vaginal douche after delivery of the placenta. The analogy between the indications for the ante-partum and the post-partum douche is not, as some have supposed, perfect. Before delivery the vaginal mucous membrane is intact and bathed in the acid bactericidal mucus of the vagina. Hence, as Krönig has shown experimentally, ante-partum douches, by diluting and washing away this mucus, actually delay the destruction of pathogenic germs previously introduced into the vagina. After delivery the conditions are quite different and all conditions for the propagation of sepsis are present. Hence it seems proper that one thorough vaginal douche should be given. Nothing but a glass tube should be used, and this should be perforated at the sides, the perforations looking a little backward, that the fluid may not enter the uterus. As the tube is introduced the labia should be carefully separated (See Part X) and the tube carried as far as possible into the vagina without touching the surrounding tissues. When few or no vaginal examinations have been made, the post-partum douche should be omitted. It may be said to carry a risk of infection with it, but not to the same extent as the digital vaginal examination (Figs. 192 and 193). In intelligent hands the irrigation is practically free from danger. It certainly, in my experience, adds to the comfort and safety of the patient: (1) by causing the uterus and vagina to expel retained clots; (2) by setting up firm uterine contraction which prevents hemorrhage and after-pains; (3) the warmth lessens the pain of the laceration and stretching to which the vagina has been subjected. An intrauterine douche is given only when the hand or instruments have been introduced into the uterus, or when there is other reason to suspect the possibility of intrauterine sepsis.

Fig. 637.—Inspection of Placenta and Membranes immediately after the Third Stage. Hand is Passed into Amniotic Cavity and same Distended while Inspecting the Cotyledons of the Placenta.—(*From a fresh specimen.*)

Cleansing of the Patient and Bed.—At the completion of the third stage the external genitals should be carefully cleansed with boiled water and with bichloride solution (1 : 4000); the cleansing should include the thighs, buttocks, and lower surface of the abdomen, since these are usually soiled by blood, perhaps by urine and feces. The temporary bedding should be removed and its place supplied by that which is perfectly clean, and the patient should be given, if necessary, a clean night-dress.

Vulval Dressing.—A sterile napkin, preferably an antiseptic pad of some absorbent material, should be applied to the vulva and held in position by a band carried between the thighs and fastened anteriorly and posteriorly to the abdominal binder by safety-pins. This vulval dressing should be changed as often as it becomes soiled. Deodorizing chemicals or those with any odor should not be used on the vulval dressing, as these mask the fetor of decomposing lochia, a valuable sign of early septic infection.

Abdominal Binder.—This contributes to the comfort of the patient and is usually desirable. It should be of unbleached muslin and wide enough to reach from below the trochanters to the lower ribs. The attendant should stand on the patient's right and the binder should be fastened from below upward. This should be done by taking the part of the binder next to the abdomen in the left hand and the part which is to be external in the right and holding them together with one hand while the pins are inserted from below upward with the right hand. A moderately tight abdominal binder promotes involution of the uterus. After a few days it may be applied more loosely, but may be discarded when the patient leaves her bed. (See Part VI.)

Presence of the Physician.— The physician should be within call for at least an hour after the completion of the third stage, and should not leave his patient until good uterine contraction has been secured and her pulse has become normal, or is at least below 100.

Nourishment, Rest, and Sleep.—When the third stage has been completed and the patient made comfortable, she should receive some light nourishment, as a cup of milk, weak tea, chocolate, cocoa, or soup. All visitors should be banished from the lying-in chamber; the curtains should be drawn, the room well ventilated, and the patient allowed to secure as much sleep as possible, undisturbed by the washing, dressing, or crying of the child.

PART FIVE.

Pathological Labor.

DUE TO ABNORMAL CONDITIONS OF THE FETUS: FETAL DYSTOCIA.

FETAL DYSTOCIA FROM FAULTY ATTITUDE. (Page 499.) I. Excessive Flexion of Head. Roederer's Obliquity. II. Bregma Presentation. Incomplete Flexion. III. Brow Presentation. IV. Face Presentation. V. Presentation of Anterior Parietal Bone or Ear. Naegele's Obliquity. VI. Presentation of Posterior Parietal Bone or Ear. Litzmann's Obliquity. VII. Prolapse of the Arms. Dorsal Displacement of the Arm. VIII. Prolapse of the Leg. IX. Prolapse of the Cord.

FETAL DYSTOCIA FROM FAULTY PRESENTATION. (Page 527.) X. Pelvic Presentation. XI. Shoulder Presentation.

FETAL DYSTOCIA FROM FAULTY POSITION. (Page 545.) XII. Persistent Occipito-Posterior Position. XIII. Persistent Mento-posterior Position. XIV. Transverse Position of Head at Outlet.

FETAL DYSTOCIA FROM GENERAL FETAL CONDITIONS. (Page 554.) XV. Multiple Birth. XVI. Multiple or Compound Presentations. XVII. Excessively Long Cord. XVIII. Short Cord. XIX. Rupture of the Cord. XX. Decapitation of the Fetus. XXI. Avulsion of Fetal Extremities. XXII. Malformations, Deformities, and Anomalies Producing Dystocia. XXIII. Fetal Rigor Mortis.

DUE TO ABNORMAL CONDITIONS IN THE MOTHER: MATERNAL DYSTOCIA.

MATERNAL DYSTOCIA FROM THE FORCES. (Page 567.) I. Precipitate Labor. II. Protracted or Retarded Labor. Uterine and Abdominal Inertia.

MATERNAL DYSTOCIA IN THE PARTURIENT TRACT AND ADNEXA. (Page 574.) III. Retention of Placenta and Membranes. IV. Post-partum Hemorrhage. V. Rupture of the Uterus. VI. Inversion of the Uterus. VII. Excessive Right Lateral Obliquity of Uterus. VIII. Rupture of Cervix, Vagina, Rectum, Perineum. IX. Labor after Anterior Fixation or Suspension of Uterus.

MATERNAL DYSTOCIA FROM OBSTRUCTED LABOR. (Page 602.) X. Uterine, Ovarian, Renal, Peritoneal Tumors. XI. Anomalies of the Membranes. XII. Rigidity of the External and the Internal Os. Trismus Uteri. XIII. Deviation or Malposition of the Os. XIV. Occlusion of the External Os. XV. Cancer of the Uterus. XVI. Rigidity and Atresia of the Vagina and Vulva. XVII. Vaginal and Vulval Thrombosis and Œdema. XVIII. Distended Bladder and Rectum. Cystocele, Rectocele, Vesical Calculus. XIX. Fractures of the Pelvis. XX. Diastasis of Pelvic Joints. XXI. Pelvic Deformity.

MATERNAL DYSTOCIA FROM GENERAL MATERNAL CONDITIONS. (Page 665.) XXII. Labor in Elderly Primiparæ. XXIII. Intestinal Hernias. XXIV. Cardiac and Pulmonary Disease. XXV. Cerebral and Spinal Disease. XXVI. Digestive Disturbances. XXVII. Sudden Death. XXVIII. Post-mortem Delivery. XXIX. The Metrorrhagia of Labor.

Pathological labor or dystocia—the latter term from two Greek words meaning difficult or painful labor—is one which departs from the conditions of physiological labor, as set forth on page 375. A multitude of variations, accidental and pathological, may arise on the part of the mother or the fetus to cause this variety of labor. Originating in the latter they cause *fetal dystocia*, and in the former *maternal dystocia*.

According to my classification I shall describe fetal dystocia as due to: (1) faulty attitude; (2) faulty presentation; (3) faulty position; and (4) general fetal conditions. Maternal dystocia I divide into dystocia from (1) the forces; (2) the parturient tract and adnexa; (3) obstructed labor; (4) general maternal conditions.

DUE TO ABNORMAL CONDITIONS OF THE FETUS: FETAL DYSTOCIA.

FETAL DYSTOCIA FROM FAULTY ATTITUDE.

Faulty attitude or posture of the fetus may be caused by anything which alters the normal shape of the fetal ovoid (see page 421). Thus, dystocia may be due to a faulty attitude caused by any deviation of the fetal head from the normal position of flexion. According to the degree of extension present will be the variety of the malpresentation which will result. (1) Thus, occasionally excessive flexion (Fig. 638), or Roederer's obliquity, under certain conditions may act as a cause of fetal dystocia. (2) If the flexion is incomplete to a slight degree only, so that the chin departs only a short distance from the sternum, the bregma will present instead of the vertex and a bregma presentation results. (3) If a greater degree of extension occurs and the head occupies a position upon its transverse axis, midway between flexion and extension, the brow or the region immediately in front of the bregma will present, giving a brow presentation. (4) And if complete extension take place and the chin is the presenting part, a face presentation results. (5) Further, should lateral flexion of the head occur so as to cause the anterior parietal bone or the ear to present, the condition known as Naegele's obliquity occurs. (6) Should the lateral flexion result in presentation of the posterior parietal bone or the ear, the obliquity is called Litzmann's. Faulty attitude may also result in prolapse of the (7) arms, (8) legs, (9) umbilical cord.

I. EXCESSIVE FLEXION OF THE HEAD; ROEDERER'S OBLIQUITY.

Excessive flexion of the head upon the trunk has been termed Roederer's obliquity (Fig. 638). This is nothing more than an exaggeration of the normal head flexion of labor whereby the occiput enters the inlet perpendicularly, the

head moulding being more to the posterior part of the head, with the apex well back on the occipital bone, thus positively providing for the engagement of the suboccipito-bregmatic circumference, 11 inches (28 cm.), in the circumference of the inlet, 16 inches (40.5 cm.), and is to be looked upon as a favorable condition. The *causes* are excessive rigidity of the cervix or vagina, generally contracted pelvic inlets, or excessively large fetal heads, especially in dead or macerated fetuses. The *diagnosis* is simple. In left positions of the head the small fontanelle is more to the right and very little of the sagittal suture can be felt; the large fontanelle is unusually high. The *prognosis* is not necessarily favorable at the pelvic inlet, although after the engagement of the head the conditions never cause dystocia. Because of the obstruction sometimes produced at the inlet by excessive flexion of a large head of a dead or macerated fetus, causing the shoulders and head to attempt to enter at the same time, I have classed this condition among the causes of fetal dystocia. Many authorities refer to the condition only under normal labor. Treatment may be demanded at the inlet to assist in the engagement of the head, since the tonicity of the neck has been lost in macerated fetuses. After engagement no treatment is required.

EXCESSIVE FLEXION OF HEAD. ROEDERER'S OBLIQUITY.

FIG. 638.—OCCIPUT AT THE PELVIC INLET.

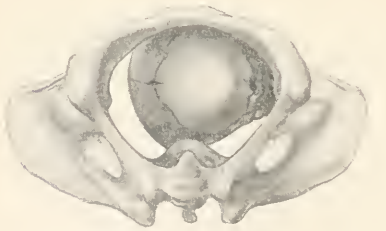

FIG. 639.—OCCIPUT AT THE PELVIC INLET.

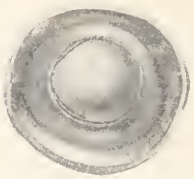

FIG. 640.—OCCIPITAL BONE IN THE CERVIX.

II. BREGMA PRESENTATION.* INCOMPLETE FLEXION.

Definition.—By this condition is meant a partial extension of the head whereby the large fontanelle is brought upon the same plane as the small (Fig. 641).

Frequency.—Authorities generally state that incomplete flexion resulting in a bregma presentation is rare. My experience is that dystocia from this source is most common. I believe it to be one of the most important factors in the production of prolonged and tedious labors, either from tardiness in the rotation from a posterior to an anterior position due to the incomplete flexion, or because the occipto-frontal circumference ($13\frac{3}{4}$ inches—35 cm.) instead of the suboccipito-bregmatic (11 inches—28 cm.) is brought in relation to the periphery of the birth canal.

Temporary and Persistent Varieties.—A close observer cannot fail to detect instances in which incomplete flexion of the head or bregma presentation has

* The bregma is the anterior fontanelle.

occurred both as a temporary and as a persistent condition. Temporary descent of the large fontanelle is frequently observed in all the four positions of the vertex in normal labors during the engagement of the head in the inlet, but more frequently in roomy pelves after the head has passed the psoas muscles and entered the roomier part of the pelvis, also in slightly and decidedly flattened pelves in conjunction with Naegele's lateral flexion and presentation of the anterior parietal bone. In the case of flattened pelves the biparietal diameter becomes arrested at the contracted inlet, the narrower bitemporal diameter of the sinciput descends, engages, and passes the inlet, followed, after a period of moulding, by the biparietal and restitution of the head to its normal state of complete flexion. In the persistent variety, although the same etiological factors may obtain, still for some reason the condition becomes permanent.

BREGMA PRESENTATION OR INCOMPLETE FLEXION OF THE HEAD.

VERTEX TO THE LEFT.

FIG. 641.—BREGMA AT THE PELVIC INLET.

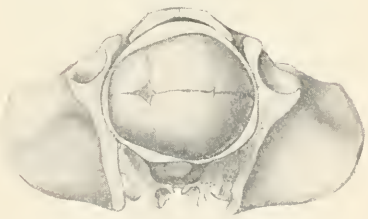

FIG. 642.—BREGMA AT THE PELVIC INLET.

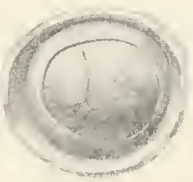

FIG. 643.—IN THE CERVIX: RIGHT PARIETAL BONE AND HALF OF FRONTAL PRESENTING.

Etiology.—This is the same as in brow and face presentations, although in some instances dolichocephalic conditions of the fetal head play an important part (pages 503 and 509).

Positions and Relative Frequency.—The positions and their relative frequency are the same as in vertex presentations, as the anatomical conditions differ very little from those of normal labor.

Mechanism.—While some authorities consider that bregma presentation demands a description of a special mechanism, I am accustomed to describe the condition as merely a departure from the mechanism of vertex presentation due to moderately incomplete flexion of the head. The mechanism differs from that of normal vertex presentation in that departure from the normal occurs by reason of the increased circumference of the presenting part, and, further, the imperfect flexion brings the forehead down as far as the vertex, thus interfering with internal anterior rotation. It must be remembered that labor is not impossible in all cases of this condition, and that the several steps in the mechanism can be recognized as in other presentations. Should the partial extension be uncorrected, the mechanism is as follows: Moulding is extensive by reason of the delay. Since the occipito-frontal diameter (4.5 inches—11.50 cm.) and circumference ($13\frac{3}{4}$ inches—35 cm.), and not the suboccipito-bregmatic diameter ($3\frac{3}{4}$ inches—9.5 cm.) and

BREGMA PRESENTATION OR INCOMPLETE FLEXION OF THE HEAD.

VERTEX TO THE RIGHT.

FIG. 644.—BREGMA AT THE PELVIC INLET.

FIG. 645.—BREGMA AT THE PELVIC INLET.

FIG. 646.—IN THE CERVIX: LEFT PARIETAL BONE AND HALF OF FRONTAL PRESENTING.

FIG. 647.—AT THE PELVIC FLOOR.

circumference (11 inches—28 cm.), are brought in relation with the diameters and circumference of the pelvic inlet, persistent bregma presentations undergo prolonged and characteristic moulding (Fig. 649). Engagement and descent are slow by reason of the greater circumference involved; rotation of the head fails altogether because the vertex and forehead are equally influenced by the factors causing rotation, or is accomplished only with the greatest difficulty and much damage to the maternal soft parts. Labor often comes to a standstill by reason of the transverse position of the occipito-frontal diameter on the pelvic floor. The perineum begins to tear even before the head has reached it, on account of the great dilatation of the upper vagina by the large cephalic diameters. The laceration becomes extensive, extending through the sphincter ani and even up the recto-vaginal septum. In expulsion of the head the latter is born by propulsion and partial extension. Rotation and delivery of the trunk occur as in normal labor.

Diagnosis.—This is not difficult. Whenever on vaginal examination the large fontanelle is readily made out as occupying a prominent place in the circumference of the parturient canal with the sagittal, frontal, and coronal sutures radiating therefrom, the condition may be looked upon as one of bregma presentation or incomplete flexion of the head. This presentation in its clinical features resembles a brow, as the supraorbital ridges may often be palpated well up anteriorly, posteriorly, or laterally. (Figs. 646 and 642.)

Prognosis.—This is usually good, as the condition is readily recognized and remedied. When overlooked, all the dangers of tedious labor and secondary inertia are to be feared.

Treatment.—Immediate correction of the incomplete flexion should be made either (1) by pushing the forehead up during uterine contraction with two fingers in the vagina, at the same time making pressure upon the fundus;

or (2) the whole hand may be introduced into the vagina and either the occiput drawn down or the forehead pushed up, counterpressure being at the same time made upon the podalic extremity of the fetus through the fundus, or upon the occiput through the lower uterine segment. (See Correction of Bregma, Brow, and Face Presentations, Part X.)

MOULDING OF HEAD IN BREGMA PRESENTATION.

III. BROW PRESENTATION.

Definition.—A partial extension of the head whereby the brow instead of the vertex becomes the presenting part. The head is so extended in this presentation as to occupy a position midway between complete flexion and complete extension (Fig. 650).

Frequency.—This is the rarest of all cephalic presentations and occurs in one-fourth of one per cent. of all cases. As brow presentation is a transition stage in the development of face presentation, it is, considered temporarily, as frequent as the latter. But as generally estimated—those which remain brow till artificially altered—they are far less common than the face. In a series of 2200 consecutive confinements I found brow presentation in 3 cases, or 0.13 per cent., or 1 in 733 cases. Face presentation occurred in 5 cases, or 0.22 per cent., in the same series.

FIG. 648.—BEFORE MOULDING.

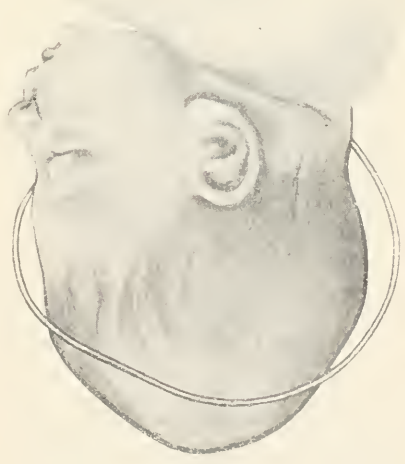

FIG. 649.—AFTER MOULDING.

Etiology.—Any cause which favors incomplete flexion or partial extension of the head may cause a brow presentation; the causes are, therefore, the same as those for face presentation. (See page 509.) If the brow is not converted by natural means into a face presentation, the inference must be drawn that there is a greater obstacle present than in cases in which face presentation develops. The forces exerted on the two arms of the head-lever in brow presentation are almost equal, the posterior arm being just a little longer than the anterior (Fig. 648).

Positions and Relative Frequency.—There are four cardinal positions of the brow, as in other presentations:

I. Left fronto-anterior—Fronto Læva Anterior—L. F. A. (Fig. 650).
II. Right fronto-anterior—Fronto Dextra Anterior—R. F. A.

FIRST BROW POSITION.
LEFT FRONTO-ANTERIOR, L. F. A.

FIG. 650.—BROW AT PELVIC INLET.

FIG. 651.—BROW IN THE CERVIX.

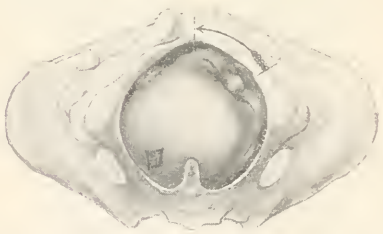

FIG. 652.—AT PELVIC FLOOR BEFORE ANTERIOR ROTATION OF BROW.

FIG. 653.—IN THE VULVA AFTER ANTERIOR ROTATION OF THE BROW.

III. Right fronto-posterior—Fronto Dextra Posterior—R. F. P.

IV. Left fronto-posterior — Fronto Læva Posterior—L. F. P. (Fig. 654).

As in vertex presentation, the third and first positions are the most frequent, and in the order named.

Mechanism.—(1) Brow presentation, being often a transitional condition between vertex and face presentation, may at any stage in the mechanism of labor be converted into one of these spontaneously. (2) Again, with a roomy pelvis and a small fetus, the latter in brow presentation may be pushed through the pelvis without any special mechanism. (3) In exceptional cases in which the fetal head is relatively small, special mechanisms of brow presentation can be recognized, as follows:

III. RIGHT FRONTO-POSTERIOR, R. F. P.—(1) *Moulding:* This process is so slow that sometimes labor pains continue for hours—twenty-four to thirty-six—before engagement of the brow takes place. In the unusual cases in which a brow presentation enters the pelvis, there has been an extreme moulding of the head, the latter being rather small; the caput succedaneum occupies the space from the root of the nose to the anterior fontanelle. A side view of the head shows it to be rather triangular in shape. (See Figs. 659 and 660.) The occipito-mental diameter has decreased, but this has been compensated for by an increase of the occipito-frontal. The shape of the head is now characteristic of this presentation. The slope of the parietal and occipital bones is downward and backward, while the forehead is almost perpendicular. (2) *Engagement and Descent:* Because of the altered shape of the head the forehead sinks into the pelvis more deeply than any other part of the head and the head is somewhat extended as it passes through the pelvic inlet. The course of the brow to the pelvic floor is due to energetic contractions of the uterus, causing the mother much pain.

Labor usually comes to a standstill at this stage of engagement and descent by reason of obstruction. (3) *Anterior Rotation of the Forehead* (Fig. 656): If the presentation remains unchanged until expulsion, the forehead finally reaches the pelvic floor and rotates anteriorly for the same reasons as the occiput does in vertex presentation. At the same time the vertex rotates posteriorly into the hollow of the sacrum. The brow lies opposite the vulva, the face just back of the pubis with the chin at its upper margin, and the superior maxilla against the symphysis. Anterior rotation of the brow at the pelvic floor may, in exceptional cases, possibly occur, but more often labor comes to a standstill with a deep transverse position of the head. (4) *Expulsion of the Head* (Fig. 657): Before the head has appeared outside the vulval orifice, the neck and the body of the child have descended somewhat into the pelvis. The flexion of the head is increased as the forehead appears in the vulva; the perineum then retracting. Expulsion is accomplished by the cranial vault first sweeping forward over the perineum; then the eyes, nose, superior maxilla, mouth, and chin successively make their appearance under the symphysis pubis, and are born. (5) *Rotation of the Trunk and Restitution of the Head* (Figs. 653 and 657): After delivery of the head, shoulder rotation and restitution of the head occur as in vertex presentation. In the right fronto-posterior position the left shoulder rotates to the symphysis and restitution of the child's face to the left thigh occurs. (6) *Expulsion of the Trunk:* This is the same as in vertex and face presentations (page 447).

I, II, and IV. Left Fronto-anterior, L. F. A.; Right Fronto-anterior, R. F. A.: and Left Fronto-posterior, L. F. P. (Fig. 654), follow the same general principles as the above.

Persistent Posterior Rotation of the Brow.—As in permanent occipito-pos-

FOURTH BROW POSITION.
Left Fronto-Posterior, L. F. P.

Fig. 654.—Brow at Pelvic Inlet.

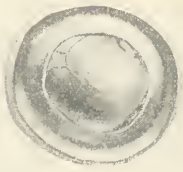

Fig. 655.—Forehead in the Cervix.

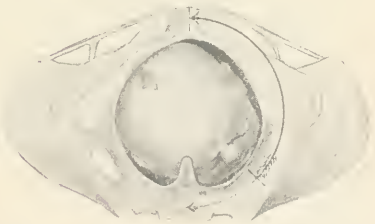

Fig. 656.—Brow at the Pelvic Floor before Anterior Rotation of the Forehead.

Fig. 657.—Delivery of the Head after Anterior Rotation of the Brow.

terior and mento-posterior positions, arrest may occur at the pelvic inlet, or after engagement of the brow. As in face presentation with the chin posteriorly, the difficulties of spontaneous delivery are so great that birth may be said to be impossible unless anterior rotation of the brow occurs.

	Position of Fetus.	Position of Fetal Heart Sounds.
Left fronto-anterior. L. F. A.	Brow to left acetabulum; back to right; extremities to left, above.	Right side of abdomen, below umbilicus.
Right fronto-anterior. R. F. A.	Brow to right acetabulum; back to left; extremities to right, above.	Left side of abdomen, below umbilicus.
Right fronto-posterior. R. F. P.	Brow to right sacro-iliac joint; back to left; extremities to right, above.	Left side of abdomen, below umbilicus.
Left fronto-posterior. L. F. P.	Brow to left sacro-iliac joint; back to right; extremities to left, above.	Right side of abdomen, below umbilicus.

Diagnosis.—By abdominal examination the two ends of the head may be discovered to be at about the same level (Fig. 654). Unless the subject is readily palpated, the diagnosis of a brow presentation by external palpation is very difficult. By vaginal examination the small fontanelle and the orbital ridges are felt at opposite points in the available space, while the large fontanelle and the coronal, frontal, and sagittal sutures are between (Figs. 651 and 655).

Fig. 658.—Persistent Posterior Position of the Brow.

Prognosis.—This is uncertain for the mother and very bad for the fetus. Maternal mortality is as high as 10 per cent.; fetal mortality has reached 30 per cent. The dangers to the mother are exhaustion from prolonged labor due to obstruction, severe laceration of the parturient canal, sepsis, and shock. The dangers to the child are excessive moulding and compression of the skull, causing apoplexy or asphyxia; prolapse of the cord is a common complication, as in deformed pelves, because the brow imperfectly fits the pelvic inlet. The family must be warned that the child's face will be swollen and hideous as in face presentation. It is quite possible for spontaneous rectification of a brow presentation to occur at any stage of the mechanism of labor. This, however, cannot be relied upon any more than in shoulder presentation.* Sometimes, though

* Ahlfeld ("Die Entstehung Steiss- und Gesichtslagen") furnishes twenty-six cases in which the result to both mother and child is given. Fritsch ("Klinik der alltäglichen geburtshülflichen Operationen," p. 46) gives the histories of seven cases, and Budin ("Tête du Fœtus," p. 53) the history of one case. In the thirty-four deliveries there were two maternal deaths; in one of the fatal cases a coxalgic oblique pelvis existed as a complication. In the other the brow spontaneously changed into a face presentation. There were ten spontaneous deliveries, the brow presenting with four dead children, but one died previous to labor. There were ten cases of spontaneous delivery in which the brow during

rarely, if the fetus is very small, or the pelvis very large, the fetus may be delivered without any mechanism or danger. In reality the prognosis will depend on the operation which is chosen for delivery of the child. An unchanged brow position with normal head will require so much time for spontaneous delivery that the obstetrician cannot conscientiously wait for nature to complete the birth.

Treatment.—One must never trust to spontaneous rectification; manual correction of the faulty attitude into a vertex presentation, or even into a breech by podalic version, gives better results than waiting for spontaneous delivery with the brow presenting. Correction of a brow presentation by changing the posture of the woman, and also, I may add, by external manipulation alone, as in Schatz's method (Part X), are refinements of obstetric procedure which rarely succeed and unnecessarily disturb the patient. Further, in this as in other faulty attitudes, presentations, or positions of the head when the fetus is positively determined to be dead,

MOULDING IN BROW PRESENTATION.

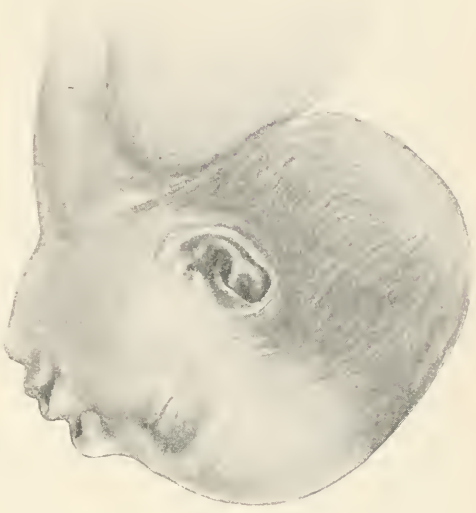

FIG. 659.—BEFORE MOULDING.

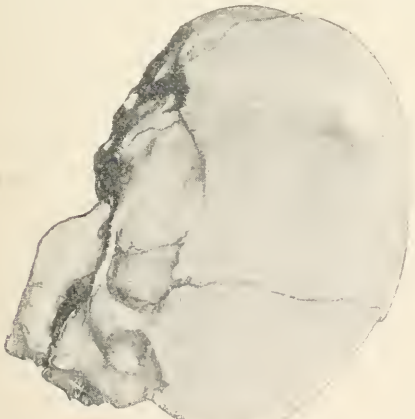

FIG. 660.—FETAL SKULL SHOWING MOULDING IN BROW PRESENTATION.—(*Author's collection.*)

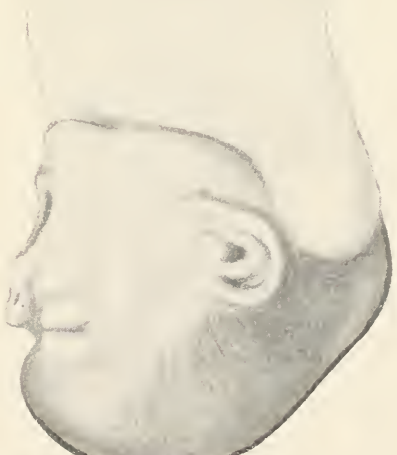

FIG. 661.—AFTER MOULDING IN FRONTO-ANTERIOR POSITION.

delivery became converted into either a face or a vertex presentation. Of these one child died. Fourteen children were extracted with forceps, nine with the brow presenting, of which two were dead, one from prolapsed funis, and one which had died before labor; five after conversion into face or vertex presentations, with no deaths. Thus among the thirty-four children there were seven deaths, but of these, four only could be attributed to the presentation.

perforation of the skull and extraction with the cranioclast or cephalotribe should always be performed when by so doing the prognosis for the mother is improved. Arguments from the standpoint of sentiment alone should never deter us from mutilating the head of a dead fetus in order to lessen the dangers of extracting an unmutilated head through the birth canal.

1. *Before Engagement of the Brow.*—(1) Placing the parturient on the side toward which the dorsal plane of the fetus points, or an attempt at manual correction by external manipulation by Schatz's method (see Part X), may be tried, but it offers little hope of success. (2) Manual conversion of the brow into a vertex by combined internal and external methods is the best treatment. Digital upward pressure on the brow; lifting up the brow with the whole hand; drawing down upon the occiput with the whole hand, or one of these methods combined with Schatz's method, and all combined with external manipulation, as described in Part X, should be tried, and in the order named. Flexion, once obtained, must be maintained until engagement takes place, otherwise the brow presentation will recur. These indications obtain at the pelvic inlet, in both fronto-anterior and fronto-posterior positions of the brow. Of course, the conversion of the former into a vertex presentation results in an occipito-posterior position at the inlet, but even this position of the vertex offers a better prognosis than a brow presentation. To extend the head manually in fronto-anterior positions and convert the brow presentation into a mento-anterior position of the face, is a most questionable procedure; and in view of the serious prognosis in face presentations, I would be unwilling to recommend it. Salowieff,* however, in 18 brow cases occurring in the Moscow Maternity Hospital during a period of ten years, found that 10 were terminated by version and expression, 1 by forceps, 1 spontaneously, 1 in a vertex presentation, and 5 in face presentations. The last five were treated by introducing a finger into the child's mouth, drawing the chin toward the brow, and retaining the finger in the mouth until the uterine contractions fixed the head in the converted face presentation. Simplicity and safety are claimed for this procedure. The unfavorable prognosis of face presentation has, however, still to be met. (3) The forceps in a true brow presentation should never be resorted to before at least partial rectification of the faulty attitude, for the unusually large circumference of the presenting part results disastrously for the fetus and mother. (4) Failing in manual rectification, one of the methods of version, followed promptly by extraction, offers the best prognosis, always provided the necessary conditions for version are present or can be secured. (See Part X.)

2. *After Engagement of the Head.*—(1) An attempt at manual rectification as described above should be made. (2) The use of the forceps is dangerous and difficult, and must only be tentatively attempted. (3) Symphyseotomy, undoubtedly, in the presence of a living fetus, offers the only hope after manual rectification fails, and should be seriously considered. (4) In all instances in which the fetus is known to be dead, perforation of the head should be performed.

IV. FACE PRESENTATION.

Definition.—A face presentation may be defined as a cephalic presentation in which the head is in extreme extension, with the occiput in contact with the neck. The face engages in the pelvis with the chin as the most dependent portion. Face positions are therefore classified, in accordance with the location of the chin, as right and left mento-anterior and posterior (Figs. 663, 667, 671, 675).

* "Centralbl. f. Gynäk.," Leipzig, 1898, No. 30.

Frequency.—About 1 labor in 250 is a face presentation (0.5 per cent.). This represents an average, as individual statistics show considerable variations. In 2200 cases of labor I found that face presentation occurred in 5 cases, or 0.22 per cent., or 1 in 440 cases(Fig. 662). (Compare Pelvic Deformity.)

Etiology.—At first sight face presentation appears to be a simple anomaly of the mechanism of labor, the result of some obstruction in the parturient tract which unflexes and extends the head. Regarded from this simple point of view, a face presentation would be looked upon as a consequence of pelvic contraction, and perhaps of rigid os, prominent ischial spine, and the like. But this assumption is by no means easy of demonstration, nor is there any necessary ratio between the frequency of particular types of obstruction of the birth tract and deflexion anomalies. Some other factors must contribute to its production. Both observation and theory point to the possibility that anomalies in the fetal head or neck are often concerned in the production of this presentation. Some of the conditions which reside in the fetus and interfere with normal flexion are: congenital goitre, spastic contraction of the muscles of the neck, coiling of the cord about the neck, etc. But conditions of this sort occur with too great infrequency to account for the production of face presentation. Moreover, the factors thus far enumerated do not account for all the face births encountered in practice, or even, according to some authorities, for the majority of them. We have to look upon face presentation as something more than an anomaly of the mechanism of labor; or, in other words, it must be placed in the same category with breech and shoulder presentations. From this point of view we are able to add to our etiological factors the causes of malposition in general; including prematurity, contracted pelvis, hydramnios, multiple pregnancy, monstrosities, etc. These, however, cannot be brought into direct relationship with the effects produced, and the connection between the two is a matter of statistics rather than of actual demonstration. It is evident that we must look still more deeply into the matter before we can exhaust all possible etiological factors. Only one element remains for consideration, viz., the uterus itself. Matthews Duncan was able to trace a relation between lateral deviation of the uterus and certain face births; and other authorities have similarly held the triangular and saddle-shaped types of uterus responsible for the latter in certain cases. The individual causal elements which are at present recognized by most authorities may be divided as follows: (1) Causes of malposition in general, such as prematurity, contracted pelves, hydramnios, twin pregnancy, monstrosities, etc., and the conditions covered by Schatz's hypothesis. (2) Causes residing

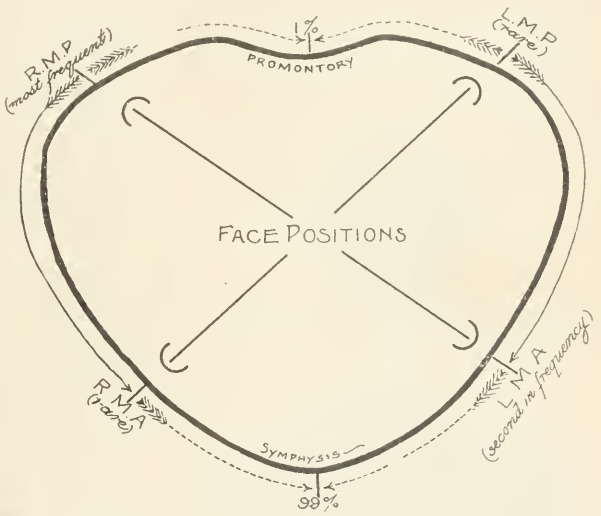

FIG. 662.—DIAGRAM SHOWING THE FREQUENCY OF FACE POSITIONS.

FIRST FACE POSITION.
LEFT MENTO-ANTERIOR, L. M. A.

FIG. 663.—FACE AT PELVIC INLET.

FIG. 664.—CHIN AND LEFT CHEEK IN THE CERVIX.

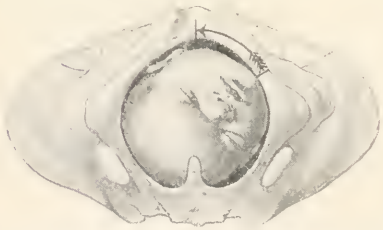

FIG. 665.—FACE AT PELVIC FLOOR BEFORE ANTERIOR ROTATION OF THE CHIN.

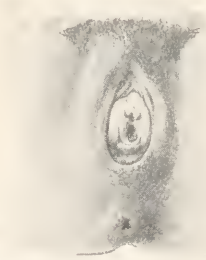

FIG. 666.—FACE IN THE VULVA AFTER ANTERIOR ROTATION OF THE CHIN.—(*Author's photograph.*)

in the uterus, such as lateral obliquity, triangular and saddle-shaped uteri, pendulous abdomen (Fig. 151), etc. (3) Causes residing in the fetus which interfere with flexion or favor extension. These are numerous and varied and include: large head from any cause; long head; tumor of occiput; spastic rigidity of neck muscles—all of which produce extension; and congenital goitre, coils of cord under the chin; obesity and dropsical condition; muscular hypotonus of the asphyxiated and dead child—all of which prevent flexion. (4) Causes residing in the parturient canal: narrow pelvis, especially short transverse diameter; rigid os; the projecting rim of a placenta prævia; prominent ischial spine; distended maternal bladder.

Ahlfeld regards all causes resident in the uterus or fetus as primary, and all causes which obtain in the birth passages as secondary. In Winckel's cases, 30 per cent. had hydramnios; 22 per cent. had coiling of the cord about the child; 30 per cent. had contracted pelves, etc. The most frequent association in these cases, in Winckel's experience, is contracted pelvis, large child, and pendulous abdomen.

Position and Relative Frequency (Fig. 662).

I. Left mento-anterior, mento læva anterior, L. M. A. (Fig. 663), second in frequency.

II. Right mento-anterior, mento dextra anterior, R. M. A. (Fig. 667).

III. Right mento-posterior, mento dextra posterior, R. M. P. (Fig. 671), most frequent.

IV. Left mento-posterior, mento læva posterior, L. M. P. (Fig. 675).

The relative frequency of the several positions is, first, right mento-posterior; and, second, left mento-anterior. Right mento-anterior and left mento-posterior are very rarely seen. (Compare Presentation, page 423, and Fig. 662.)

Mechanism.—I. LEFT MENTO-ANTERIOR, L. M. A. (Fig. 663).—The part played by the occiput in vertex presentation is simulated by the chin in face presentation. Face presentation, however, differs somewhat in the mechanism

of labor from vertex, although the same general principles obtain. The forces act at a disadvantage in face presentation. (1) The direction of uterine contraction is not in direct line with the lowest portion of the presenting part as in vertex presentation (Fig. 684). (2) The cervical vertebræ, owing to extension of the head, are bent almost at right angles, hence the head is dragged rather than pushed through the pelvis, with a resulting tremendous friction, loss of power, prolonged labor, and dangerous compression of the vessels of the neck. (3) Again, in the internal rotation of the face another difficulty in the ordinary mechanism of labor presents itself. Anterior rotation of the chin does not occur so readily as anterior rotation of the vertex because the distance from the trunk to the chin is less than from the trunk to the occiput. The depth of the sides of the pelvis is $3\frac{1}{2}$ inches (8.75 cm.) and the distance from the trunk to the chin in face presentations is about 2 inches (5 cm.), hence, either the neck must be elongated in order to allow the chin to reach the resistance of the pelvic floor or the shoulders and thorax must enter the pelvis with the face. The second is impossible without causing impaction, and the first results in prolonged labor and danger to the fetus, hence interference is often called for in face presentations at the time of rotation of the chin anteriorly. Further, when the chin finally reaches the pelvic floor, the irregular, soft, often œdematous chin is not acted upon so positively by the factors which produce anterior rotation as is the regular, hard vertex, and hence the tardy rotation of the face and greater necessity for instrumental interference in this stage of the mechanism of labor in face presentation. (1) *Extension and moulding of the head:* The head passes through several stages of inclination before complete extension is reached, and the occiput lies close to the dorsum. During this process moulding takes place to a certain extent, though it is difficult of accomplishment and requires a long time. This is due to the mature ossification of the bones and sutures of the face. The

SECOND FACE POSITION.
RIGHT MENTO-ANTERIOR, R. M. A

FIG. 667.—FACE AT PELVIC INLET.

FIG. 668.—CHIN AND RIGHT CHEEK IN THE CERVIX.—(*From author's drawing.*)

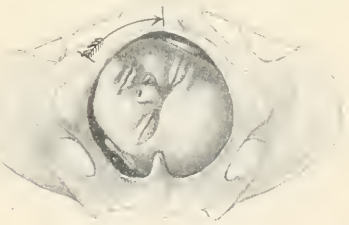

FIG. 669.—FACE AT THE PELVIC FLOOR BEFORE ANTERIOR ROTATION OF THE CHIN.

FIG. 670.—DELIVERY OF THE FACE AFTER ANTERIOR ROTATION OF THE CHIN.—(*Author's photograph.*)

THIRD FACE POSITION.
RIGHT MENTO-POSTERIOR, R. M. P.

FIG. 671.—FACE AT PELVIC INLET.

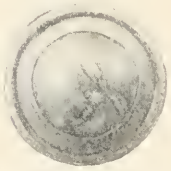

FIG. 672.—CHIN AND RIGHT CHEEK IN THE CERVIX.—(*From author's drawing.*)

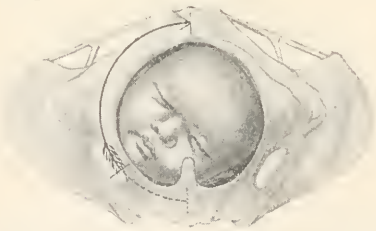

FIG. 673.—FACE AT THE PELVIC FLOOR BEFORE ANTERIOR CHIN ROTATION.

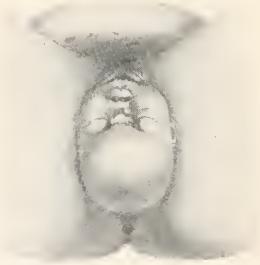

FIG. 674.—DELIVERY OF THE HEAD AFTER ANTERIOR ROTATION OF THE CHIN.—(*Author's photograph.*)

shape of the head after an ordinary face delivery is that of a flattened arch, while the frontal bones are increased in their convexity and the supra-occipital is pressed back. (Figs. 680 and 681.) The diameter of the face occupying the right oblique diameter of the inlet is the cervico-bregmatic, and this is so long ($3\frac{3}{4}$ inches—9.5 cm.) that it necessitates quite extensive moulding of the head, especially if the adaptation is inclined to be close. The entire back of the head must be bent downward and pressed against the neck. (Fig. 680.) The anterior or left cheek is on a lower level than the posterior (Fig. 664). In face presentations the cheek which comes first, or the anterior one, is the seat of the caput, and the size of the latter will be in accordance with the amount of time which elapses before anterior rotation of the chin occurs. Delay after rotation involves the entire face in the formation of a caput. If there is no unusual delay in extension, the lower part of the face is exposed, while in case of delay the caput is formed at the upper portion of the face. (2) *Engagement and descent of the face* (Fig. 665): The chin is the main point of the mechanism, and it is so far ahead of the cervico-bregmatic diameter that it is deep in the pelvis by the time this diameter has passed the pelvic inlet. Here sometimes occurs a temporary standstill for a time, for if the region of the sagittal suture remains in the sacro-iliac notch, the sacral promontory will prevent the head from turning backward, while all this time the lower part of the anterior sulcus is imparting continually a forward impetus to the chin. The contractions of the uterus as well as extension of the neck of the fetus bring the fetal face to the floor of the pelvis. The extension of the fetal neck sometimes amounts to 2 inches (5 cm.) before the chin and the pelvic floor are brought into contact. (3) *Anterior rotation of the chin* (Fig. 665): In order that anterior rotation of the chin may take place, the force of propulsion must be strong enough to press the chin down to the lowest point possible in the pelvis. After the occiput passes the

sacral promontory the chin rotates anteriorly under the symphysis pubis, while the bregma sinks into the hollow of the sacrum. (4) *Flexion and expulsion of the head* (Figs. 666, 670, 674, 678): Internal rotation being partially or entirely complete, the force of uterine contraction causes the expulsion of the head by flexion; the chin, mouth, nose, eyes, and forehead appearing successively in the vulva. (5) *Rotation of the trunk and restitution of the head:* Following the same law as in vertex presentation (page 447), the lower or left shoulder or anterior shoulder rotates to the symphysis, causing the child's face to turn to the mother's left thigh (restitution) (Fig. 678). (6) *Expulsion of the trunk:* This is the same as in vertex presentation (page 447, Fig. 675).

II. Right Mento-anterior Position, R. M. A. (Fig. 667).—Here the same general principles obtain as regards (1) extension and moulding of the head and (2) engagement and descent, these being the same as in the left-mento anterior (Fig. 667). (3) Rotation of the chin is from right to left (Fig. 669). (4) Flexion and expulsion of the head are the same as in the L. M. A. (Fig. 670). (5) In rotation of the trunk and restitution of the head the right anterior or lower shoulder rotates anteriorly to the symphysis, and the consequent restitution of the child's face is toward the right thigh of the mother (Fig. 674). (6) Expulsion of the body follows.

III. Right Mento-posterior Position, R. M. P. (Fig. 671).—Extension and moulding of the head and (2) engagement and descent are the same as in the anterior positions, except that they are apt to be tardy, as in posterior vertex positions (page 459, Fig. 673). (3) Anterior rotation of the chin from right to left about the right half of the pelvis to the symphysis is the normal mechanism. Should anterior rotation fail, we have resulting a persistent mento-posterior position (Fig. 756). (Compare page 551.) (4) Flexion and expulsion of the head are the same as in the anterior pesitions (Fig. 674). (5) In rotation of the trunk and restitu-

FOURTH FACE POSITION.
Left Mento-Posterior, L. M. P.

Fig. 675.—Face at Pelvic Inlet.

Fig. 676.—Chin and Left Cheek in the Cervix.

Fig. 677.—Face at the Pelvic Floor before Anterior Chin Rotation.

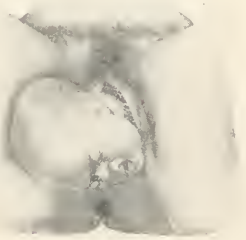

Fig. 678.—Restitution of the Head after Anterior Rotation of the Chin and Expulsion.

MOULDING IN FACE PRESENTATION.

FIG. 679.—BEFORE MOULDING.

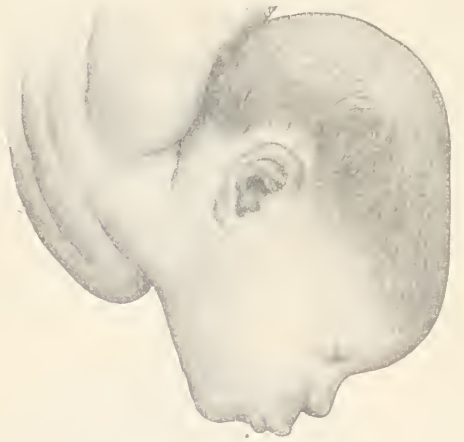

FIG. 680.—AFTER MOULDING.—(*Author's case.*)

FIG. 681.—FETAL SKULL SHOWING MOULDING IN FACE PRESENTATION.—(*Author's collection.*)

tion of the head the right anterior or lower shoulder rotates to the symphysis. (6) Expulsion of the body follows.

IV. LEFT MENTO-POSTERIOR POSITION, L. M. P. (Fig. 675).—The cervico-bregmatic diameter enters the pelvis in the left oblique diameter, the chin pointing to the left sacro-iliac synchondrosis. (1) Extension and moulding of the head and (2) engagement and descent occur as in the R. M. P. position (Fig. 677). (3) Anterior rotation of the chin from left to right about the left half of the pelvis to the symphysis is the normal mechanism. Should anterior rotation fail, we have resulting a persistent mento-posterior position (compare page 551) (Fig. 756). (4) Flexion and expulsion of the head are the same as in anterior positions (Fig. 674). (5) In rotation of the trunk and restitution of the head the left anterior or lower shoulder rotates to the symphysis (Fig. 675). (6) Expulsion of the body follows.

Diagnosis.—The recognition of facial positions by external examination has been pronounced impracticable by many diagnosticians. Ahlfeld, however, states that this type of faulty attitude may be recognized occasionally, while, according to Schatz, great pains and experience make such recognition practicable in routine diagnosis. Facial positions may be made out by external manipulation alone, before dilatation of the cervix, as follows: Pressure above the pelvic inlet reveals the presence of a prominent head (occiput). Having located the occiput in this manner, the small parts and fetal heart-sounds should be recognized on the opposite side of the uterus. The method recommended by Schatz depends for success upon mapping out the con-

vexity of the abdominal aspect of the fetus, and upon the demonstration that this convexity could not represent the normal dorsal arch of the vertex presentation (Fig. 684) and is as follows: If the fetus is in the cephalic position with breech in the fundus, the spinal convexity will be made more pronounced in a ver-

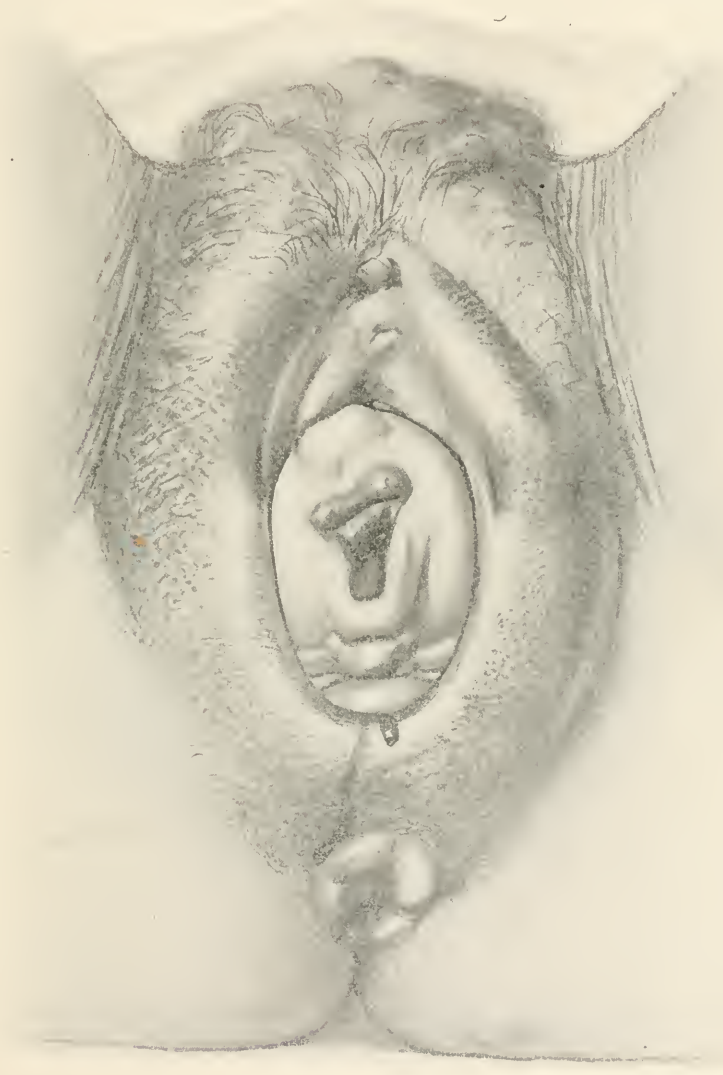

FIG. 682.—FACE PRESENTATION. Originally in the right mento-posterior position. Author's case at the Emergency Hospital.—(*From a photograph.*)

tex presentation, by pressing upon the breech in the direction of the pelvic inlet and the other hand will be able to trace the curvature from the breech downward. But in a facial presentation a convexity is also present, and an abdominal curvature which may simulate the dorsal arch. In palpating this convexity from the breech downward, the hand would locate the legs at the outset. Again, if the

height of the convexity really represents the child's chest, pressure made by the hand upon the breech may be transmitted to the hand upon the chest. In facial presentation, in comparison with the normal vertex presentation, the fetus appears to have a short back, and limbs may be felt on both sides of the uterus, the legs above and at one side, the arms below and upon the other side. This peculiarity makes it expedient to exclude the probability of a twin pregnancy

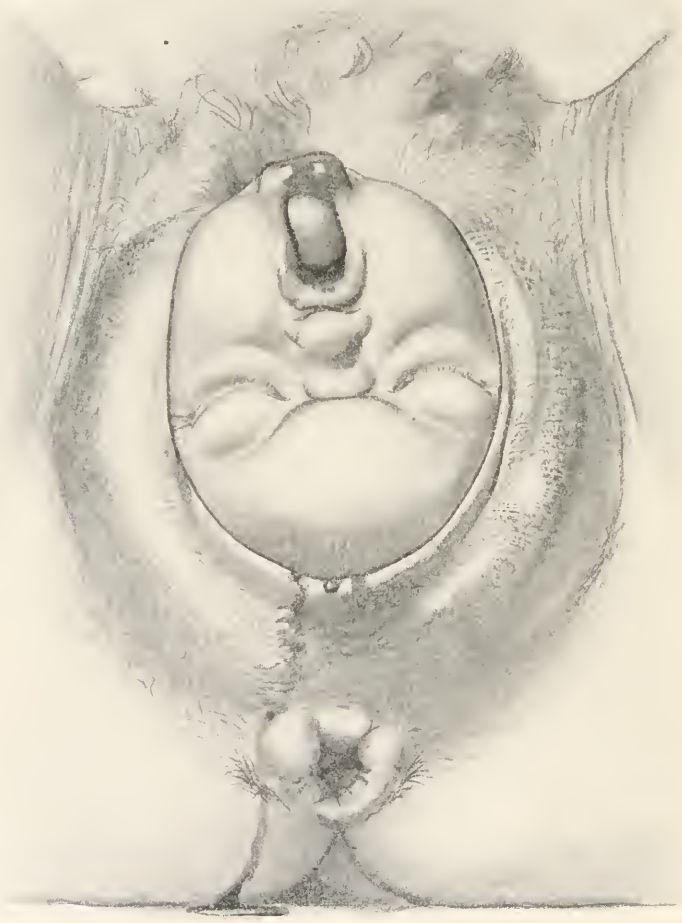

FIG. 683.—FACE PRESENTATION. Originally in the right mento-posterior position. Author's case at the Emergency Hospital.—(*From a photograph.*)

before making a diagnosis of a face presentation. In regard to internal recognition of face presentation, the usual method consists in mapping out the facial line, from the root of the nose to the chin.

Prognosis.—In primiparous labors the prognosis for mother and child is considerably more unfavorable than in vertex cases. The prolongation of labor is an element which is naturally unfavorable to mother and child alike. The

mother's condition is also prejudiced by her great efforts to expel the child, while the special danger to the latter is found in the hyperextension of the head. The danger of birth trauma, with or without subsequent infection, is present here as in all labor in abnormal positions. In multiparous labors the prognosis for mother and child is said to be but little if at all worse than in vertex presentations. The great improvement in this respect in comparison with the fatality of the remote past is to be ascribed to the recognition of the fact that face presentation can take care of itself and that patience and expectancy are valuable traits in the obstetrician, if the labor is too far advanced to permit of correction of the faulty position. In 21 face cases occurring in the Moscow Maternity Hospital during a period of ten years,* 17 terminated without assistance, 2 by forceps, and 2 by craniotomy. All the mothers recovered. An element in the prognosis is found in the position of the chin, since a much higher mortality is found in posterior positions. In the latter the mother is exposed to the danger of severe laceration of the perineum, while the child has a relatively small prospect of survival. The maternal mortality has been placed at 6 per cent.; the fetal at 15 per cent. The dangers for the mother are (1) those of protracted labor, or (2) of deformed pelvis, which latter so often complicates a face presentation. The dangers to the child are (1) those of prolonged labor; (2) cerebral congestion and apoplexy; (3) asphyxia from pressure on the vessels of the neck; (4) injury to the eyes during vaginal examination.

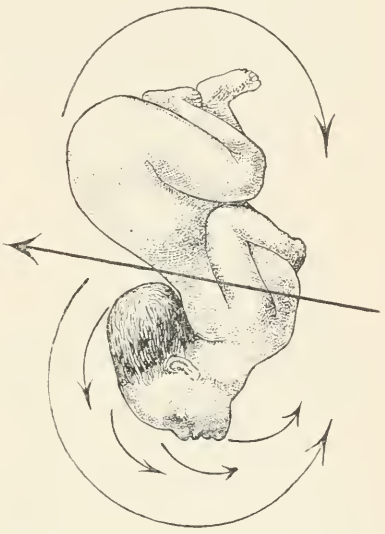

FIG. 684.—DIRECTION OF FORCES IN THE CONVERSION OF A FACE PRESENTATION INTO A VERTEX.—(*Ahlfeld.*)

	POSITION OF FETUS.	FETAL HEART-SOUNDS.
Left mento-anterior. L. M. A.	Chin to left acetabulum, forehead to right sacro-iliac joint; back to right; extremities to left.	Left side of abdomen, below umbilicus.
Left mento-anterior. R. M. A.	Chin to right acetabulum, forehead to left sacro-iliac joint; back to left; extremities to right.	Right side of abdomen, below umbilicus.
Right mento-posterior. R. M. P.	Chin to right sacro-iliac joint, forehead to left acetabulum; back to left; extremities to right.	Right side of abdomen, below umbilicus.
Left mento-posterior. L. M. P.	Chin to left sacro-iliac joint, forehead to right acetabulum; back to right; extremities to left.	Left side of abdomen, below umbilicus.

Treatment.—In this presentation more than in any other, successful treatment depends upon a thorough acquaintance with the mechanism of labor. The membranes should be preserved as long as possible, since the face is a poor dilator and the fore-water protects it from injury. The friends should

*Solowieff: "Centralbl. f. Gynäk.," Leipzig, 1898, No. 30.

be informed that the face, when born, will be very much distorted. One should recollect that in a very large proportion of cases a face presentation does not require intervention until the face reaches the pelvic floor, and this holds good in both anterior and posterior positions of the chin. Fortunately, moreover, a persistent posterior position of the chin is of rare occurrence, not more than in one per cent. of all face positions, and in spite of the fact that the right mento-posterior position is first in frequency. In the absence of other factors of maternal or fetal dystocia expectancy is the key-note in the treatment.

1. *At the Pelvic Inlet.*—In both anterior and posterior positions the case should be allowed to proceed without intervention, so long as labor progresses satisfactorily. The membranes must be preserved, however, and complete extension secured by upward pressure on the forehead. Failure of engagement of the face at the inlet calls for conversion into a vertex, followed by high forceps or spontaneous labor in posterior chin positions, and podalic version and extraction in anterior chin positions, or conversion and high forceps in both.

2. *In the Pelvic Cavity.*—Delay in anterior rotation of the chin often occurs for physical reasons, hence it must be favored by securing complete extension, by drawing forward the chin, by pushing back the forehead, or by putting the fingers or a blade of the forceps under and behind the chin, to give the latter some hard substance to act upon. (See Operations, Part X.) For the treatment of persistent mento-posterior cases see page 552.

PRESENTATION OF THE ANTERIOR PARIETAL BONE OR EAR; NAEGELE'S OBLIQUITY.

FIG. 685.—AT THE PELVIC INLET.

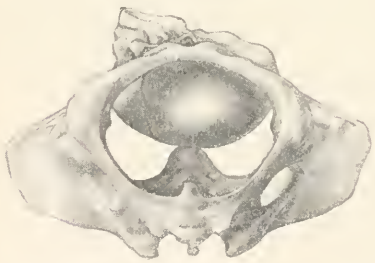

FIG. 686.—AT THE PELVIC INLET.

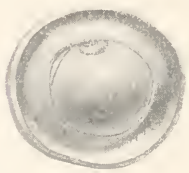

FIG. 687.—ANTERIOR PARIETAL BONE AND EAR IN THE CERVIX.

V. PRESENTATION OF THE ANTERIOR PARIETAL BONE OR EAR. NAEGELE'S OBLIQUITY. (Fig. 685.)

Normally the anterior parietal bone in vertex and bregma presentations is lowest and most prominent in the cervix and vagina. When, however, excessive lateral flexion of the head occurs, to the extent, perhaps, of the presentation of the anterior ear, Naegele's obliquity of the head is said to be present. Naturally the sagittal suture approaches the sacral promontory and the posterior parietal bone is carried upward and backward. The latter is often found flattened after delivery and even depressed or fractured, and is overlapped by the anterior. An exaggerated bregma presentation is usually present. The etiology of this complication is to

be found in a pendulous abdomen, flattened or generally contracted pelvis, or other obstruction permitting of the lateral flexion of the fetal head. The diagnosis is not difficult by ordinary vaginal palpation; but should doubt exist, the introduction of the whole hand into the vagina will remove any uncertainty. In left positions of the vertex the right parietal bone and perhaps the right ear will be found presenting; the small fontanelle high and to the left and the greater toward the right. Should the obstruction not be too great, the head may reach the pelvic floor in this way. The prognosis depends entirely upon the cause of the condition. In the lesser forms of pelvic contraction the prognosis is favorable, also when the anomaly occurs as a transient condition, which it does in about one-third of all cases. The treatment consists in relief of the pendulous abdomen or anteverted uterus with an abdominal support or bandage in pregnancy (Fig. 228), and the manual correction of the condition in labor if necessary. Nearly one-half of the cases rectify themselves spontaneously. Of course, special treatment of the case is often demanded.

PRESENTATION OF THE POSTERIOR PARIETAL BONE OR EAR. LITZMANN'S OBLIQUITY.

FIG. 688.—AT THE PELVIC INLET.

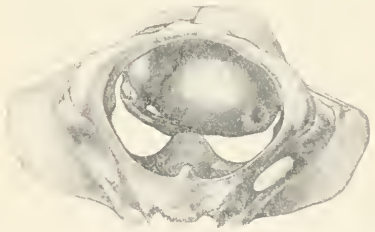

FIG. 689.—AT THE PELVIC INLET.

FIG. 690.—POSTERIOR PARIETAL BONE AND EAR IN THE CERVIX.

VI. PRESENTATION OF THE POSTERIOR PARIETAL BONE OR EAR. LITZMANN'S OBLIQUITY. (Fig. 688.)

Here the sagittal suture approaches the symphysis, with the resulting presentation of the posterior parietal bone or ear. Incomplete flexion with the sinciput lower than the occiput will often be present. The condition usually occurs in markedly flattened pelves, the latter obstruction resulting in a lateral flexion of the fetal body and head, the reverse of the Naegele obliquity. Only rarely does Litzmann's obliquity occur in normal pelves. The highest degree of this, as of Naegele's obliquity, is the presentation of an ear. The diagnosis may cause some uncertainty unless the whole hand is introduced into the vagina, when the conditions above described will be readily recognized. The prognosis will usually depend on the amount and variety of the pelvic contraction; it is favorable in the so-called spontaneous cases and in moderate degrees of contraction. It is unfavorable in a moderate degree of general contraction should the brow enter the pelvis. The treatment in spontaneous cases consists in manual correction; and in pelvic contraction, in appropriate treatment of the obstruction.

VII. PROLAPSE OF THE ARMS. DORSAL DISPLACEMENT OF THE ARM.

In an obstetric sense prolapse of the arms is important only in connection with cephalic presentations,—vertex, brow, face,—as prolapse of the upper extremities in breech and shoulder presentations has little if any effect upon the course of labor, and is rather favorable than otherwise. Presentation of a hand frequently occurs before rupture of the membranes, and after rupture either disappears by recession or the presentation is converted into a prolapse; the arm then usually occupies the hollow of the sacrum and is often combined with prolapse of the cord. If the arm is far in advance, there is a chance of the head being deflected into the iliac fossa while the shoulder descends and a shoulder presentation occurs. If, however, the hand can just be palpated by the side of the head, it is likely that the latter will be born first while the hand stays behind. Also the hand when at the side of the pelvis—namely, at one end of the transverse diameter—is not so apt to be an impediment as when it lies in front, for in this latter position it encroaches on the conjugate diameter. The position of the prolapsed hand is generally at one end of the bitemporal diameter. Sometimes rotation is interfered with. If, however, the hand lies against the occiput, it may prevent its descent at least for a time, and cause head extension at the pelvic inlet (Figs. 693, 695, and 696).

FIG. 691.—LATERAL OBLIQUITY OF THE HEAD IN VERTEX PRESENTATION.

Etiology.—The causes are found in anything that disturbs the natural relationship of the presenting part with the pelvic inlet. Thus malpresentations, such as shoulder, brow, or face, are causes, since they do not properly engage at the inlet; or anomalies in the shape of the uterus which have developed during pregnancy from some cause or are due to tumor, hydramnios, or twins; or displacement due to a pendulous abdomen. Pelvic contraction, as in the prolapse of the cord, is a common cause, as it prevents a proper adjustment of the presenting part to the inlet. For the same reason multiple presentation, as in twins, and a premature fetus are causes. Rupture of the membranes in the sitting or standing posture, especially in multiparæ, and sudden exertion on the part of the mother during or even after engagement of the presenting part, must be recognized as etiological factors. Death of the fetus with loss of its muscular tonicity must also be included.

Diagnosis.—This is a simple matter, and the possibility of this accident should always be one of the mental queries at all first and subsequent internal examinations of labor.

Prognosis.—In shoulder and breech presentations prolapse of one or both arms is rather a favorable condition, and affects the prognosis accordingly. For this reason I am never accustomed to replace the prolapsed arm or arms under such circumstances. The advantage lies in the fact that we can usually apply a sling or soft fillet to the arm or arms, keep them prolapsed, and thus the subsequent danger of the arm or arms becoming extended and causing impaction of the after-coming head is obviated. Prolapse of an arm in vertex presentation is often a serious condition. The arm occupying the inlet with the vertex may result in a lateral deviation of the head, and a vertex presentation may thus be converted into a bregma, brow, or face, or, if the head is freely movable, even into a shoulder. Or, a less serious condition, an arm prolapsed behind the symphysis may cause lateral flexion and presentation of the anterior parietal bone (Naegele's obliquity) or of the posterior (Litzmann's obliquity). The cause of the prolapse—whether it originates in the bony pelvis, the maternal soft parts, or the fetus—must not be lost sight of as affecting the prognosis.

Treatment.—(1) In shoulder and breech presentations no treatment, in my opinion, is required, other than to secure the prolapsed arm or arms with a sling in order to prevent subsequent extension alongside or above the after-coming head. (2) In instances of prolapse of an arm or arms with the head when the latter is well engaged, an expectant treatment should be followed; and if delayed labor occurs, endangering fetus or mother, the forceps should be applied to the head, care being taken not to include the prolapsed arm, and the fetus extracted as in medium or low forceps operations. It will facilitate extraction if moderate traction is also made with a sling to the prolapsed arm. Impaction in the case of a dead fetus of course demands perforation. (3) Manual reposition of the arm may be preceded, as a matter of duty, by an attempt at postural reposition—namely, placing the patient in the exaggerated semi-prone, knee-chest or Trendelenburg posture. Postural reposition alone rarely succeeds. (4) When the head is movable at the inlet or is extra-medial by reason of the prolapsed arm filling in one side of the pelvis, and the arm thus constitutes an actual obstruction, manual reposition should be performed. This is the same as in the case of a prolapsed leg. (See page 522.) (5) Version and extraction may be required if reposition fails and indications of delayed labor demand intervention.

Dorsal Displacement of the Arm (Figs. 692, 694).—In cephalic and breech presentations it occasionally happens that an arm is not only prolapsed, but is so displaced that the forearm lies transversely across the back of the neck behind the occiput and forms a ridge or elevation in the generally uniform fetal ellipse which may catch upon the pelvic inlet or a rigid cervix and constitute a serious obstruction to labor. **Diagnosis:** The condition is the more dangerous because, as no appreciable change occurs in the presentation, it naturally escapes diagnosis unless the hand of the attendant is passed above the head to explore for the cause of delay. Such an exploration under ether is always called for when forceps-indication with no marked disproportion between the head and fetus is evident and traction fails to bring down the head. **Treatment:** (1) In Cephalic Presentation.—In spite of the obstruction the fetus can sometimes (*a*) be delivered by moderate traction with the forceps. Strong traction must not be employed for fear of injury to the fetal neck. (*b*) The forceps failing, an attempt should be made with the hand passed between the shoulder and the pelvic wall to flex the forearm back into its proper place over the scapula, and the lateral and anterior thoracic walls. Fracture of the arm is occasionally unavoidable. (*c*) The forceps and manual rectification having failed, combined or internal podalic version under

proper conditions of fetus and uterus must be performed. (2) In Breech Presentation and Breech Extraction.—Delay here from dorsal displacement of the arm is more important than in cephalic presentation, since shorter time is allowed for removing the obstruction and fetal asphyxia in the mean time is liable to occur. (*a*) A conservative as well as effective plan of procedure is to bring down the non-displaced arm, to put a sling upon it, and, by using this arm as a tractor as well as by grasping the trunk, to rotate the latter in the direction that will disengage the displaced arm. (*b*) The replacement thus accomplished will usually be only partial, and it will be necessary, after rotating the displaced arm into the posterior part of the pelvis, to pass the whole or half hand into the pelvis and sweep the now partially displaced arm over the face and chest. It may possibly be necessary deliberately to fracture the arm in order to liberate the fetus in time to prevent its death by asphyxia. (Compare Part X.)

VIII. PROLAPSE OF THE LEGS.

Prolapse of the lower extremities is unusual in any presentation. It is rather favorable than otherwise in breech and shoulder presentations, and occurs, as a rule, only when the fetus is dead, immature, or macerated. In certain breech presentations there is extension of one or both thighs from vigorous movements on the part of the fetus or from sudden outflow of liquor amnii. Thus one or both feet or one or both knees or a knee and a foot present. An influencing factor in this condition is the fact that the breech does not fully occupy the lower uterine segment, especially when there is much liquor amnii. **Frequency:** Footling presentations are said to occur once in 92 cases, or in a little over 1 per cent. of all breech cases. Knee presentations are very rare, occurring once in 3000 cases. The simultaneous presentation of hand and foot is extremely rare. **Treatment:** (1) In shoulder and breech presentations no treatment is required other than to secure the prolapsed leg with a sling. In the rare instances in which prolapse of the leg occurs with cephalic presentation (vertex, brow, or face) the treatment will vary according to circumstances (Figs. 696, 697). (See Part X.)

IX. PROLAPSE OF THE UMBILICAL CORD.

Synonyms: Prolapsus Funis; Chorda Prævia; Funicular Presentation.

Definition.—In this condition a loop of the umbilical cord descends into the pelvis in advance of the presenting part. If the membranes remain unruptured, the condition is known as presentation of the cord, but after rupture, when the cord descends into the vagina, it is called prolapse of the cord. Before rupture, the loop of cord may be felt through the membranes moving in the liquor amnii, and from the very beginning of labor it presents at the pelvic inlet. It may be carried down by the sudden outflow of liquor amnii when the membranes rupture, or the loop may be forced down by muscular action by the side of the engaged head, and thus escape from the vulva. Sometimes both arms of the loop are seen side by side; in other cases the two parts are separated by a fetal part. The most common position in which the loop is found is in front of one of the sacro-iliac joints or of the cotyloid cavity. It is seldom directly in front of the sacrum or behind the pubic arch. The last-named positions are most dangerous, as they give most chance for compression of the cord by the fetal parts (Figs. 700 and 701).

Frequency.—The frequency of this complication varies, in different countries

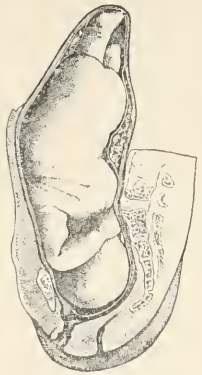

FIG. 692.

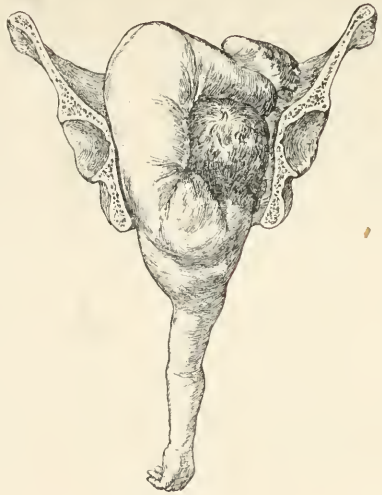

FIG. 693.

FIG. 694.

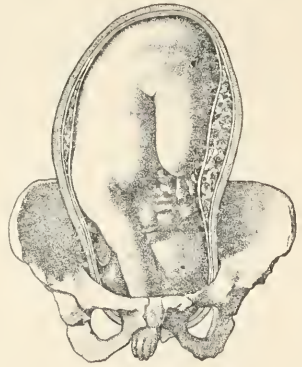

FIG. 695.

FIG. 696.

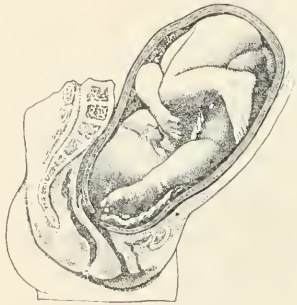

FIG. 697

FIG. 698.

FIG. 699.

and in different institutions, with the frequency of pelvic deformity and the posture of the parturient woman during labor. On the whole, it is not very infrequent. One estimate gives it as occurring once in from 200 to 300 cases of labor, but the limits according to various authors, range between one in 65 and one in 500 cases. In 2200 confinements in New York city I found the cord was prolapsed in 26 cases, or in 1.18 per cent., or once in 84.6 cases.

Etiology.—The cause of this condition is found in a lack of accommodation between the presenting part and the lower uterine segment and the pelvic inlet. Malpresentations, malpositions, deformities of the head, and contractions of the pelvis act as predisposing causes. In 26 cases of prolapse of the cord I found 14 vertex presentations, 1 brow, 3 shoulder, and 8 breech, one of the last being a prolapsed foot as well. In 9 of the 26 cases some form of pelvic contraction was present. Eight of the cases were in primiparæ and 18 in multiparæ. Excessive right lateral obliquity of the uterus, uterine fibromata or myomata, hydramnios, too long cord, marginal insertion of the cord, placenta prævia, plural pregnancy, multiparity, pendulous abdomen, a male fetus, complex presentation, or the presence of a very small fetus in premature labor, predispose to prolapse of the cord. Cases have been reported in which this complication has occurred in successive pregnancies, and in the absence of an obvious cause, predisposition has been said to be the etiological factor. The upright position on the part of the mother at the time of rupture of the membranes, and a sudden escape of the liquor amnii, may act as exciting causes, as may also violent movements, or efforts at bearing-down, particularly if ergot has been used prematurely in the last instance.

FIG. 700.—PROLAPSE OF THE CORD IN VERTEX PRESENTATION.

Diagnosis.—The diagnosis differs somewhat whether made before or after the rupture of the membranes. It should be simple enough after the rupture of the membranes, especially if the loop of cord has fallen into the vagina or outside the vulva. It may be distinguished from a prolapsed intestine by the absence of a mesentery, and by the characteristic twists of the umbilical cord which can be felt, and, if the child still lives, by the presence of pulsation in the cord. In some cases, however, pulsation in the cord ceases a short time before the death of the child, so that the heart should be auscultated before death is decided to have occurred. If the membranes are still unruptured and the pulsation is absent, the diagnosis is not quite so clear. Pulsations which occur in the vaginal or uterine arteries may be distinguished from those of the cord by being synchronous with the pulse of the mother. Before the escape of the liquor amnii, the cord, being non-resisting, is pushed ahead of the examining finger until it is really beyond palpation. Prolapsed cord has also to be differentiated from the presence of a foot or a hand in the vagina, an ectopia of the fetal intestines, and an œdematous and lacerated lip of the cervix.

Prognosis.—The mortality among *children* in this condition amounts to 50

per cent. The prognosis for the child depends on the time of labor at which the prolapse occurs, the presentation and position of the fetus, the condition of the membranes, the condition of the cervix, the amount of cord prolapsed, and the gravity of the abnormality causing the accident. The great danger for the child is from asphyxia due to compression of the cord. Head presentation carries the greatest danger with it. The danger is less in proportion to the greater length of time that the membranes remain intact, and, after their rupture, in proportion to the rapidity of delivery. The amount of the cord prolapsed and the region of the pelvis into which it descends also influence the prognosis. The fetal mortality is higher in primiparæ and in oversize of the fetus.

The prognosis for the *mother* depends upon the gravity of the abnormality which causes the accident, and of the operation demanded. Mental disturbance and breast complications subsequent to the death of the fetus may have some effect on the mother. Cases do occur in which, from various causes, the cord is tightly stretched, and is thus so shortened that the placenta is prematurely detached, with resulting hemorrhage. In my 26 collected cases, one mother died on the fifth day, undoubtedly as the result of the operation to save the child, and 5 of the 26 children were still-born.

FIG. 701.—PROLAPSE OF THE CORD IN A DOUBLED FETUS, THE ANTERIOR FETAL PLANE PRESENTING.

Treatment.—The treatment of this condition is most important because of the high mortality among children. Whatever measures are instituted should be promptly applied.

1. PREVENTIVE TREATMENT consists in posture of the parturient, preservation of the membranes, and immediate correction of lateral displacement of the presenting part. Many cases are due to improper management of labor. The membranes should never be ruptured prematurely without a positive indication, and the waters should never be allowed to gush from the uterus when the woman is in the erect or sitting posture. With an excess of the liquor amnii, a gradual escape of the waters should be aimed at by partially occluding the vaginal outlet with gauze or cotton. In conditions favoring prolapse the woman should be kept in the dorsal posture during the first as well as the second stage.

2. CURATIVE TREATMENT.—If the child is dead, the presentation or prolapse of the cord does not, of course, constitute a special indication, for the interests of the mother do not require that the fetus shall be extracted at once.

In the curative treatment of presentation of the funis *before dilatation of the cervix* has taken place, or rupture of the membranes, active interference is not indicated. Every effort should be made to prevent the premature rupture of the membranes. For this purpose a Barnes bag may be introduced, or the vagina may be tamponed. The patient should be cautioned against straining, and should assume the exaggerated latero-prone position (Part X) on the side opposite to that on which the cord lies, in order that gravity may favor the return of the displaced cord. The knee-chest position is also frequently useful in causing the return of the cord. If the fetal heart-sounds begin to fail, the cord should be pushed up be-

tween the pains, care being taken not to rupture the membranes. This should be done while the patient is in the knee-chest position. If the cord does not return, the membranes should be ruptured, and sufficient descent of the head secured to retain the cord, by expression of the fetus or by using forceps. After the cord has been replaced, the patient should lie upon the side, as above described, and with the hips elevated by a pillow. If the accoucheur possesses the requisite experience and skill, and if the mother's condition permits, he may perform version by the combined method, but without bringing down the foot into the vagina. The foot should be secured by a fillet.

In the treatment of presentation of the funis *after dilatation of the cervix*, if the head remains above the brim and cannot be made to engage, there are two alternatives: manual or instrumental reposition and version. Too much handling of the cord, however, is dangerous to the fetus. If reasonable efforts at reposition fail, version should be performed, unless it is so dangerous to the mother as to be considered unjustifiable.

Manual reposition is best done while the patient is in the exaggerated latero-prone or knee-chest position. While counter-pressure is made over the fundus, the hand should be passed into the cervix, the head pushed a little to one side, and the cord carried up beyond the head, and, if possible, to a position behind the neck. During this manipulation the cord should be balanced on the tips of as many fingers as possible and not grasped in the hollow of the hand. This act of reposition should be done as rapidly as possible. Manipulations should be suspended during uterine contractions. The hand should be gradually withdrawn, and the descent of the head into the cervical canal aided by pressure over the fundus, or the application of the forceps. After reposition the woman should be placed on the side opposite to that at which the prolapse developed.

Instrumental reposition will become necessary if rupture of the membranes takes place before dilatation of the cervix, since the time occupied in securing dilatation would very likely prove fatal to the child. The best repositor is an ordinary English catheter (See Part X). The stylet is made to pass out from the eye of the catheter, a loop of disinfected bobbin is passed loosely around the cord, and is attached to the stylet, which is then withdrawn into the catheter and pushed to the tip, in order to hold the tape in position. The catheter and cord are then carried up as far as possible, the stylet is withdrawn to avoid possible compression, and the catheter is left in position. Every effort should then be made to induce engagement as described above. If efforts at reposition are not promptly successful, manual dilatation, followed by version or forceps, according to the indications, should be performed. Another method of slinging the cord is shown in Part X.

In face presentations version should be performed, unless there are contra-indications, since the face does not completely fill the cervical canal, and the replaced loop is likely to re-prolapse. In prolapse of the foot in breech presentations the cord is not in danger until the breech enters the cervix. In breech presentations pressure upon the cord may be relieved by bringing down a foot, but if the fetal heart-sounds begin to fail, extraction should be as rapid as is consistent with the safety of the mother. In shoulder presentations no modification of the usual management is indicated. In the very rare cases in which the head is impacted, or has passed the inlet, and the cord pulsates, the use of the forceps is indicated. After the child is dead the condition does not call for interference. If there are still other complications, such as placenta prævia or shoulder presentation, the same treatment is indicated as at first

described. When prolapsed cord offers the only complication, it should be restored as quickly as possible. Throughout the management of the case the operator or an assistant should listen at intervals for the fetal heart. If asphyxia appears to be impending before dilatation of the cervix is complete, the Braxton-Hicks method of version may be performed, although the foot should not be brought below the level of the os, where it may be held by a sling until dilatation is complete. If fetal asphyxia is impending after dilatation is complete, podalic version should be performed if the head is movable at the inlet; otherwise forceps must be applied. In my series of 26 cases, above quoted, with a fetal mortality of 19.2 per cent., 8 children were delivered by forceps, 9 by version, 4 by manual extraction in breech cases, and 3 spontaneously. Records are wanting in 2 cases.

FETAL DYSTOCIA FROM FAULTY PRESENTATION.

X. PELVIC PRESENTATION.

Definition.—Pelvic or breech presentation represents positions of the fetus in which the inferior pole of the fetal ellipse is found at the pelvic inlet, in the vagina, or at the vulva. It is classed as a longitudinal presentation, and therefore is amenable to the conditions of that class. The positions are named in accordance with the location of the fetal sacrum (page 529). It is unnecessarily complicating to describe in this connection a foot and knee presentation. Prolapse of the feet and legs is merely a complication of a pelvic presentation as prolapse of the cord and hands is in other presentations—vertex, bregma, brow, face, or shoulders. It is useful, however, to distinguish between a simple pelvic presentation and a mixed one. In a *simple breech* presentation the lower extremities are flexed on the anterior surface of the body. Flexion is limited to the hip-joint, the knee being in extension. The breech alone presents at the inlet. (Figs. 703, 704). In a *mixed breech* presentation the lower extremities maintain the physiological attitude throughout, hips, knees, and ankles alike exhibiting some degree of flexion; so that the feet are found in some relationship with the breech at the pelvic inlet—perhaps above, perhaps below (Fig. 707).

Frequency.—Statistics covering a vast number of child-births show that about one labor in thirty-two is a breech presentation, the percentage being 3.2. A large proportion of breech cases is found in premature deliveries, multiple pregnancies, and anomalous labors (page 423). Simple breech occurs in about 60 per cent. of cases. In 2200 labors I found pelvic presentation occurred in 82 cases, or 3.72 per cent., or once in 26 labors.

Etiology.—The etiology of breech cases is complex, so that the theoretical causal factors cannot always be brought into relationship with this anomalous presentation. In general it may be stated that anything which interferes with the normal shape of the fetal ellipse or changes the shape of the ovoid uterine cavity after the thirty-second week may result in a malpresentation, such as pelvic; in other words, there is failure of one or more factors governing the determination of vertex presentation (compare page 424). Certain conditions predispose to breech presentations: (1) First, the causes of faulty attitude in general, including pelvic, shoulder, and possibly face presentation. These include, on the part of the mother, relaxation of the uterine and abdominal walls, abnormal mobility of the uterus (conditions found in women who have borne many chil-

dren); distention of the uterus (hydramnios), deformity of the uterus, whether due to malformation (uterus arcuatus, bicornis, etc.) or to fibroids; contracted pelvis; placenta prævia. (2) On the part of the fetus the corresponding factors are prematurity (we must expect breech presentation in every second case of labor before the eighth month, page 423); multiple pregnancy; monstrosities; fetal diseases, dead and macerated fetuses. We frequently see the coincidence of several of these factors in a given case.

FIG. 702.—MIXED BREECH PRESENTATION. COMPARE FIG. 707.

Positions and Relative Frequency.—

I. Left sacro-anterior, Sacro læva anterior, L. S. A. (Fig. 706), most frequent.

II. Right sacro-anterior, Sacro dextra anterior, R. S. A. (Fig. 715).

III. Right sacro-posterior, Sacro dextra posterior, R. S. P. (Fig. 719), second in frequency.

FIG. 703.—SIMPLE BREECH PRESENTATION.

FIG. 704.—SIMPLE BREECH PRESENTATION.

IV. Left sacro-posterior, Sacro læva posterior, L. S. P. (Fig. 723).

The left sacro-anterior is the most frequent, and the right sacro-posterior the next. In 163 pelvic presentations, Naegele found 120 left sacro-anterior and 40 right sacro-posterior. The same factors determine the relative frequency of the several breech positions as those of the vertex (page 426). To understand this one must keep in mind the shape of the fetal ellipse; the shape of the uterine cavity; the torsion of the uterus upon its long axis, and the fact that in pelvic as in vertex presentation the longest horizontal diameter of the fetal ellipse is an antero-posterior and not a transverse diameter (Figs. 702, 704). This is brought about by the flexion of the thighs, legs, arms, and head upon the anterior fetal plane in the normal attitude or posture (page 420).

Mechanism.—I. Left Sacro-anterior, L. S. A. (Fig. 706).—The same stages obtain here as in the mechanism of vertex presentation. The bitrochanteric diameter (Fig. 707) approaches the pelvic inlet in the latter's left oblique diameter, the fetal back looking to the left and front (Fig. 706). (1) *Moulding of the breech:* Increased intrauterine pressure results, in addition to moulding, in more perfect flexion of the limbs and head. No movement analogous to flexion in vertex or extension in face presentation occurs, nor does a typical tumor like the caput succedaneum form. This process is also one of adaptation The breech is swollen either from simple œdema or the condition may be more severe and present a much enlarged, dark surface. It is more commonly seen over the anterior hip, though it may reach the genital regions, especially the scrotum in males. If the knees or feet present, they may become œdematous. (2) *Engagement and descent:* By reason of the irregular shape of the breech this stage is often prolonged. The left anterior or lower hip first enters the inlet and cervix (Figs. 707 and 708) and slowly the uterus forces the breech onward into the pelvic cavity until the left hip meets with the resistance of the pelvic floor. (3) *Anterior rotation of the left hip:* Rotation of the buttocks occurs when the pelvic floor is reached. It must be clearly understood that while the greatest horizontal diameter of the fetal ellipse is the antero-posterior, yet the greatest diameter of the presenting part or breech is the transverse diameter, the bitrochanteric, 3½ inches (8.75 cm.) (Fig. 704). One must also remember that in the stage of descent that buttock or trochanter which lies in the anterior segment of the pelvis is the lowest, and hence the first to be influenced by the trough-like shape of the pelvic floor and deflected to the front at the pelvic outlet, thus bringing the long diameter of the presenting part (bitrochanteric) into the long diameter of the pelvic outlet (antero-posterior), and fulfilling the great principle in the mechanism of labor, namely, accommodation (Figs. 708, 709). The left, lower, or anterior buttock is thus brought to the

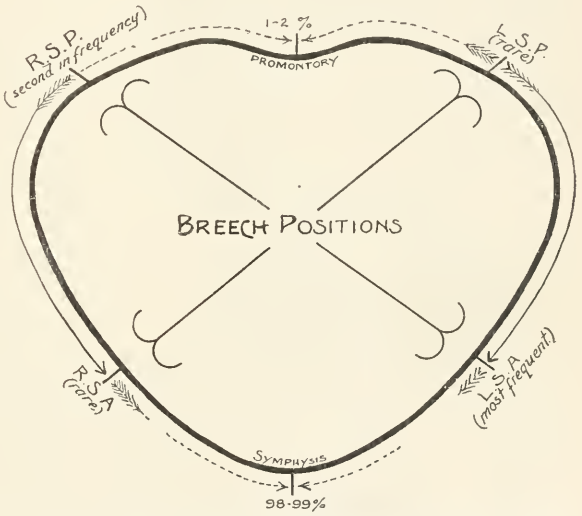

Fig. 705.—Relative Frequency of the Breech Positions.

FIRST BREECH POSITION.
LEFT SACRO-ANTERIOR, L. S. A.

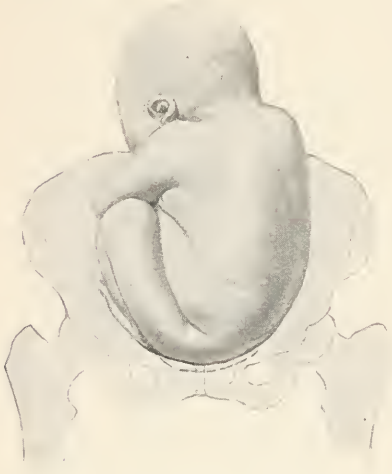

FIG. 706.—BREECH AT THE PELVIC INLET.

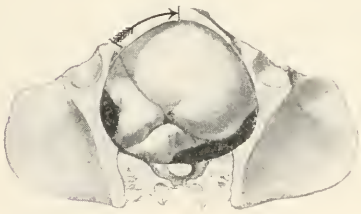

FIG. 707.—BREECH AT THE PELVIC INLET.

FIG. 708.—LEFT BUTTOCK IN THE CERVIX.

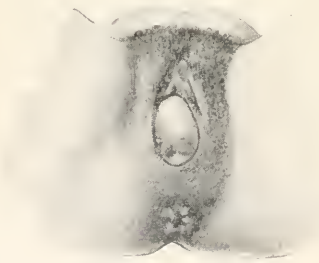

FIG. 709.—LEFT BUTTOCK IN THE VULVA.—(*From a photograph.*)

symphysis pubis by the rotation of the breech in its entirety. (4) *Expulsion of the breech and lateral flexion of the body:* When the anterior hip has reached the pubis, and the posterior the posterior portion of the pelvic floor, the impetus given the fetus by the posterior segment bends forward the breech in its entirety and a lateral curvature of the trunk occurs (Fig. 138). The lateral curvature soon becomes decided and the buttock may be seen at the vulval opening. The trunk is propelled into the pelvic cavity and the anterior hip becomes fixed beneath the pubic arch. Next the posterior hip makes onward progress until the posterior buttock appears over the fourchette, followed by the trochanter. With the birth of the posterior part of the breech the perineum withdraws from the pelvis of the fetus, and on account of the posterior surface of the breech being relieved entirely of pressure there is decreased curvature and the fetal trunk straightens out, freeing the anterior hip from its forced position against the arch of the pubis (Fig. 718). Expulsion of the trunk now readily follows. The thighs are always flexed when no prolapse occurs and the legs are often extended (Fig. 703). Extension of the legs I do not consider an abnormal condition, as it is due to the tight birth canal "peeling" them up, so to speak, along the fetal body. Normally the arms preserve their original position upon the chest of the fetus and are thus expelled. An unfortunate complication arises should one or both arms become extended along the sides of the head within the pelvis. The hips, the legs, and the trunk appear in quick succession, and the child is delivered up to its waist. Almost simultaneously the shoulders enter the inlet and the umbilicus appears at the vulva. The bisacromial diameter of the shoulder engages in the left oblique diameter of the pelvic inlet and the shoulders descend until the left, lower, or anterior shoulder reaches the pelvic floor. The left shoulder then rotates anteriorly from right to left, causing the bisacromial diameter to correspond to the antero-posterior diameter of the pelvic outlet. The anterior shoulder becomes fixed under the pubic arch. The arms, flexed on the chest,

and the shoulders, first the right or posterior, and later the left or anterior, are delivered. (5) *Rotation of the head and restitution of the trunk:* The head, regarded as a lever, is pressed upon at its longer arm by the uterus, and this serves to keep it flexed or to increase existing flexion. The head engages and descends. The occipitofrontal diameter of the head enters the pelvis in its right oblique diameter. In perfect flexion of the head and normal posture of the child the vertex or occiput is the only prominent or projecting portion. Consequently at the pelvic floor it is this pole of the head which alone meets with any resistance and, following the usual law, is deflected anteriorly, bringing the long diameter of the head into that of the outlet. Anterior rotation of the occiput we know clinically rarely fails, and then because of an extended head or some anomaly either in the shape of the head or in the parturient tract. Coincident with head rotation, slight restitution of the trunk, bringing the fetal dorsum to the front, is sometimes observed. (6) *Expulsion of the head:* Although acting at a disadvantage by reason of the relatively small size of the head, the uterus by contracting acts upon the vault of the cranium. The occiput still being the projecting and prominent portion of the head,

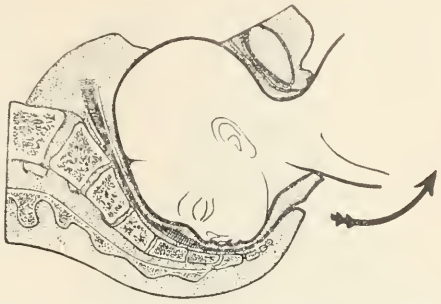

FIG. 710.—DELIVERY OF THE AFTER-COMING HEAD WITH THE OCCIPUT ANTERIOR.

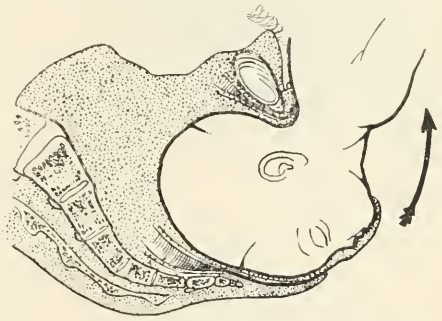

FIG. 711.—DELIVERY OF THE AFTER-COMING HEAD WITH THE OCCIPUT ANTERIOR.

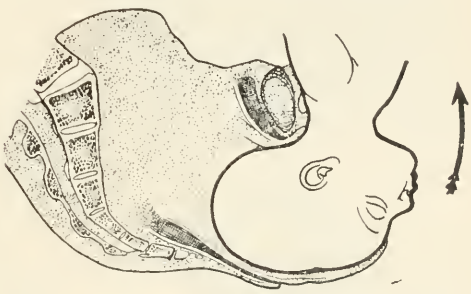

FIG. 712.—DELIVERY OF THE AFTER-COMING HEAD WITH THE OCCIPUT ANTERIOR.

FIG. 713.—DELIVERY OF THE AFTER-COMING HEAD WITH THE OCCIPUT POSTERIOR. FIRST METHOD.

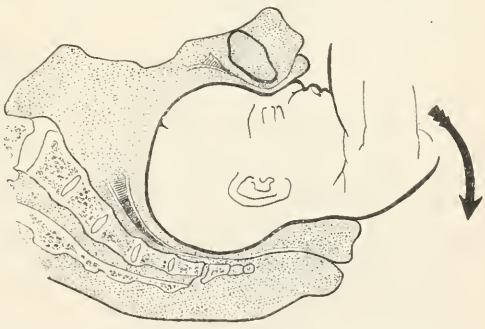

FIG. 714.—DELIVERY OF THE AFTER-COMING HEAD WITH THE OCCIPUT POSTERIOR. SECOND METHOD.

SECOND BREECH POSITION.
RIGHT SACRO-ANTERIOR, R. S. A.

FIG. 715.—BREECH AT PELVIC INLET.

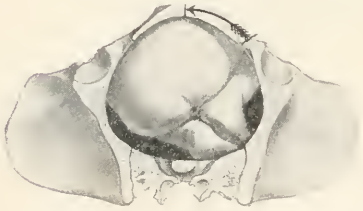

FIG. 716.—BREECH AT PELVIC INLET.

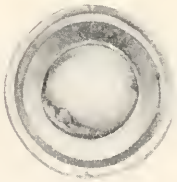

FIG. 717.—RIGHT BUTTOCK IN THE CERVIX.

FIG. 718.—BREECH IN THE VULVA. EXPULSION OF BOTH BUTTOCKS.

and in the anterior segment of the pelvic outlet, is naturally caught and held by the bony fork of the pubic arch, leaving the long or sinciput extremity of the cephalic lever to be influenced by the contraction of the uterus and pelvic floor and to be driven down into the vulval opening, causing the head to be born by a movement of flexion; the chin, mouth, nose, eyes, forehead, anterior fontanelle, and lastly the occiput passing over the perineum in the order named (Figs. 710, 711, 712).

Posterior Rotation of the Occiput.—In rare cases, not more than 2 per cent., anterior rotation of the occiput fails, the sinciput end of the cephalic lever rotates to the pubic arch and the occiput to the coccyx. This complication results from incomplete flexion of the head, whereby the sinciput of the after-coming head becomes as prominent as the occiput or more so, and hence is equally or to a great extent influenced by the greater resistance of the posterior part of the pelvic floor, and is rotated anteriorly. Two terminations of a persistent occipito-posterior position of the after-coming head are possible: (1) Uterine contractions force the sinciput, or long end of the head lever, under the pubic arch and flex the head through the vulval orifice; the chin, mouth, nose, eyes, forehead, and occiput appearing in the order named under the pubis (Fig. 714). (2) Occasionally extension of the head takes place at the pelvic inlet and the occipito-mental diameter ($5\frac{1}{2}$ inches—13.97 cm.) is brought in coincidence with the antero-posterior diameter of the inlet, thus presenting a mechanical impossibility. In these cases contraction of the uterus forces the chin over and upon the upper portion of the symphysis and thus fixes the face end of the cephalic lever. The occipital or short end of the head lever alone being free, is forced by uterine contraction down to the pelvic floor and the head is born through the vulval orifice by a movement of continued extension; the occipital protuberance, the small and large fontanelles, forehead, nose, mouth, and lastly the chin being born in the order named (Fig. 713).

II. RIGHT SACRO-ANTERIOR POSITION, R. S. A. (Fig. 715).—The bitrochanteric

diameter approaches the pelvic inlet in the latter's right oblique diameter, the fetal back looking to the right and front. (1) *Moulding of the breech:* Same as in Position I (page 529). (2) *Engagement and descent.* Same as in Position I (page 529). (3) *Anterior rotation of the right hip:* This occurs for the same reason as in Position I (page 530). (4) *Expulsion of the breech and lateral flexion of the body:* Compare Position I (page 530). (5) *Rotation of the head and restitution of the trunk:* The occipito-frontal diameter enters the left oblique pelvic diameter and the occiput rotates to the pubis from right to left (Fig. 715). Restitution occurs as in Position I. (6) *Expulsion of the head* (Fig. 710): See Position I (page 531).

III. Right Sacro-posterior Position, R. S. P. (Fig. 719).—The bitrochanteric fetal diameter approaches the left oblique pelvic diameter; the fetal back looks to the right and rear (Fig. 720). (1) *Moulding of the breech* and (2) *Engagement and descent* occur as in Positions I and II. (3) *Anterior rotation of the right hip* now occurs (Fig. 721). (4) *Expulsion of the breech and lateral flexion of the body* follow (see pages 582 and 531) (Fig. 722). (5) *Rotation of the head and restitution of the trunk:* The occipito-frontal fetal diameter enters the right oblique pelvic diameter, the occiput pointing to the right sacro-iliac synchondrosis. Rotation of the occiput follows from this latter point around the right pelvic wall and to the symphysis, for reasons already stated, in all but less than 2 per cent. of cases (Fig. 719). (6) *Expulsion of the head* now occurs as in Positions I and II (Fig. 710).

IV. Left Sacro-posterior Position, L. P. S. (Fig. 723).—The bitrochanteric fetal diameter approaches the left oblique pelvic inlet diameter; the fetal back looks to the left and rear (Fig. 724). (1) *Moulding of the breech* and (2) *Engagement and descent* occur as in Positions I and II (Fig. 725). (3) *Anterior rotation of the left hip:* This occurs from left to right to the median line (Fig. 725). (4) *Expulsion of the breech and lateral flexion of the body:* As in I, II, and III (Fig. 710). (5) *Rotation of the head and restitution of the trunk:* The occipito-frontal fetal diameter enters the left oblique pelvic

THIRD BREECH POSITION.
RIGHT SACRO-POSTERIOR, R. S. P.

Fig. 719.—Breech at Pelvic Inlet.

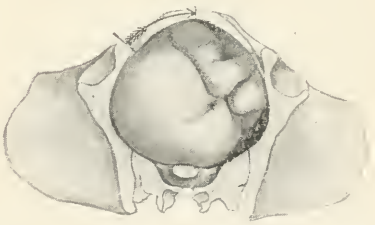

Fig. 720.—Breech at Pelvic Inlet.

Fig. 721.—Right Buttock in the Cervix.

Fig. 722.—In the Vulva. Escape of the Anterior or Right Leg.

diameter, the occiput pointing to the left sacro-iliac synchondrosis. Rotation of the occiput around the left side of the pelvis to the symphysis occurs at the floor of the pelvis (Fig. 723). (6) *Expulsion of the head* follows (Fig. 710).

Prognosis.—*For the mother:* The prognosis in respect to the mother's survival corresponds with that of occipital presentations in all cases which terminate spontaneously, although intervention is required much more frequently in breech cases. The likelihood of perineal rupture is also greater. *For the child:* The prognosis for the fetus is much more unfavorable than in occipital presentations; the average mortality being 20 per cent. The chief danger is from asphyxia, which often occurs as the after-coming head passes the pelvic inlet coincident with the birth of the navel. An additional peril is compression of the cord between the fetal parts and the pelvic bones. Complete compression for five to ten minutes is sufficient to kill a strong, healthy child. Third, premature detachment of the placenta may cause death of the child. Partial detachment often results irrespective of the fetal position when the uterus is partially emptied; but while this has no special significance in head presentations, it is otherwise when the head is still in the uterus and respiration impossible. Under these circumstances the prognosis is not necessarily ominous because it may be improved by treatment. In regard to the prognosis of particular types of pelvic presentations, the best outlook occurs in mixed breech cases, because the entire circumference of the trunk and lower extremities serves to dilate the birth tract. Conversely, if the feet constitute the presenting part, the prognosis is unfavorable because a complete foot presentation cannot dilate the birth tract sufficiently for delivery of the after-

FOURTH BREECH POSITION.
LEFT SACRO-POSTERIOR, L. S. P.

FIG. 723.—BREECH AT PELVIC INLET.

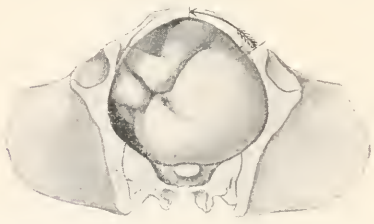

FIG. 724.—BREECH AT PELVIC INLET.

FIG. 725.—LEFT BUTTOCK IN CERVIX.

FIG. 726.—ESCAPE OF THE TRUNK THROUGH THE VULVA.

coming head. The first risk of the child, death from asphyxia, irrespective of compression of the cord or detachment of the placenta, is due to premature inspiration, produced by the contact of the born portions of the body with the cooler outside air. Respiration causes aspiration of mucus with obstruction of air-passages. Extension of one or both arms is an unfortunate complication, which still further prolongs the expulsion of the head; because the uterus cannot grasp the breech so firmly as it can the head, and thus while the fore-waters still have communication with the rest of the liquor amnii, there is premature rupture of the membranes from this unusual force of uterine contractions. Dry labor may ensue. Fractures and dislocations often occur when interference is necessary. Hematoma of the sterno-mastoid and torticollis have also been noted in connection with breech delivery.

Diagnosis.—

	Position of Fetus.	Position of Fetal Heart-sounds.
Left sacro-anterior. L. S. A.	Sacrum to left acetabulum; back to left anterior; abdomen to right posterior.	Left side of abdomen, opposite umbilicus.
Right sacro-anterior. R. S. A.	Sacrum to right acetabulum; back to right anterior; abdomen to left posterior.	Right side of abdomen, opposite umbilicus.
Right sacro-posterior. R. S. P.	Sacrum to right sacro-iliac joint; back to right posterior; abdomen to left anterior.	Right side of abdomen, opposite umbilicus and toward the back.
Left sacro-posterior. L. S. P.	Sacrum to left sacro-iliac joint; back to left posterior; abdomen to right anterior.	Left side of abdomen, opposite umbilicus and toward the back.

External Examination.—If the fundus uteri is palpated the head may be recognized in that locality in the first position on the right side and in the second position to the left (Figs. 706 and 715). The back is recognized by its uniform resistance. On the opposite side of the uterus, occupied chiefly by liquor amnii, the resistance is much less marked. In palpating over the pelvic inlet we encounter not the head but a less resistant structure. The lower extremities may be made out in the inferior uterine segment. The fetal heart should be heard, in the first position, just to the left of the median line and at the height of or a little above the umbilicus. In the second position the heart should be heard on the right side at some distance from the median line and somewhat further back, the level being the same as in the first position.

Internal Examination.—As a rule, the breech is higher up at the beginning of labor than is the head in vertex presentation. The bag of waters projects to quite an extent into the vagina, sometimes forming an elongated tumor. Now and then the tension is so great that rupture occurs with a loud report, on the same principle as the bursting of a paper bag full of air. As the cervix does not perfectly grasp the presenting part, nearly all of the amniotic fluid is lost after the membranes are ruptured. When this discharge is very rapid, the pains often decrease or cease entirely for the time being. Meconium is often mixed with the fluid. In palpating the presenting part we encounter a soft, smooth, somewhat conical surface. If we assume this to be the head, we are unable to recognize sutures, fontanelles, or hair. If we assume that we have a breech presentation, we may be able to recognize the anus, the ischial tuberosities, and the tip of the coccyx, above which is the triangular sacrum. As labor advances the genitals may be recognized, but even then an attempt to distinguish the sex is by no means easy. The anus will feel like a dimple between two skin-covered elevations. The buttock will feel like

HEAD MOULDING IN BREECH PRESENTATION.

FIG. 727.—BEFORE MOULDING.

FIG. 728.—AFTER MOULDING.—(*Author's case.*)

FIG. 729.—MOULDING OF SKULL.—(*Author's collection.*)

a soft, round tumor, through which the great trochanter will offer its resistance. If the tip of the coccyx be felt, the examining finger can trace back its connection with the sacrum. The ischial tuberosities and the external genitals also present other important landmarks. The tip of the coccyx always points away from the back of the fetus. The heels and toes also, when the two feet present, will indicate the position of the fetus.

Differential Diagnosis. — *Face and Breech:* Great care must be exercised in distinguishing a face from a breech presentation, for to the touch the similarity of the mouth and the anus may readily lead to an erroneous diagnosis. The anus lies in a fossa, while the mouth is more superficially placed. If the finger is gently introduced into the cavity, the contraction and resistance of the sphincter ani give certain evidence of a breech presentation. *Foot and hand:* The foot is recognized by the presence of the heel and the absence of the adducible thumb and by the toes being nearly in a straight line. If the child is alive, the kicking movements also distinguish between feet and hands. *Knee and elbow:* The patella in the knee can usually be distinguished from the olecranon in the elbow. In doubtful cases due to œdema, the part should be followed up to the trunk. The groin may be differentiated from the axilla by the absence of the ribs.

FIG. 730.—MOULDING OF SKULL.—(*Author's collection.*)

Treatment.—During pregnancy we can often convert the breech into a vertex presentation by external version. It will not always be found easy, however, to maintain the latter presentation. A common method of accomplishing this is to apply two long cylindrical compresses of gauze to the sides of the uterus and to hold them in place with a firm abdominal binder. I gave this method a thorough trial in the case of a physician's wife, and each removal of the binder resulted in a return to a breech presentation. External version, however, is more often successful in the beginning of the first stage, the fetus then being manually held in the vertex presentation until engagement occurs. I have succeeded with this method in several instances after labor has begun.

Successful treatment can be obtained only by a careful study and appreciation in each case of the particular mechanism of labor and of the conditions under which the life of the fetus is placed in danger. It should be remembered (1) that labor is tedious, because the buttocks constitute a slow dilator of the cervix, vagina, and vulva; (2) that the compressible trunk imperfectly dilates the passages, leaving much for the after-coming hard, incompressible, and relatively large head to accomplish in the way of dilatation; (3) that the real dangers begin when the umbilicus enters the pelvis, and are increased manifold when the umbilical cord and head occupy the pelvis at one and the same time. The principles in the treatment of pelvic presentation are: (1) To prolong the first stage of labor. This is to secure full dilatation of the passages. We accomplish this by discouraging the use of the voluntary forces and by the use of chloroform if necessary. (2) To preserve the membranes as long as possible. This also has for its object the securing of a full dilatation. To accomplish this, we make few examinations and keep the patient as quiet as possible in the recumbent position. The Germans recommend hydrostatic bags or tampons in the upper part of the vagina, but I have failed to appreciate their utility. The preservation of the membranes is of especial value in breech presentations, because the breech cannot well dilate the cervix, for the later passage of the firmer and harder head. The soft parts are frequently lacerated by the after-coming head when the breech has borne the brunt of dilating the cervix. (3) Carefully to watch the fetal heart-sounds after the rupture of membrane and to prepare for a rapid second stage. To have everything ready for the resuscitation of an asphyxiated child and to keep the position of the fetus, the mechanism of head expulsion, and the dangers clearly in mind. (4) Always to follow down the fundus. This preserves head flexion and keeps the uterus closely applied to the head, thus preventing extension of the arms. (5) To protect the perineum as in vertex cases. (6) When the umbilicus appears, to draw down the cord a few inches, to place it to the rear, if possible opposite a sacro-iliac joint, to watch its pulsations and to protect it from longitudinal stretching. (7) To wrap the child in a hot towel (100° F.) to prevent respiration from contact with the air of the lying-in room (70° F.) and to support it well to prevent pressure on the neck. (8) As the chin appears, to elevate the trunk and to assist in the expulsion of the head if necessary by suprapubic pressure (*expressio fœtus*). Much can be done at this time by urging the woman to use her voluntary muscles in bearing-down. If there is much delay, one should not hesitate to employ some form of manual extraction of the head. (See Obstetric Surgery, Part X.) Should the arms become extended along the side of the head or above it, they must be immediately brought down. (See Operations, Part X.) Should the head remain transverse at the pelvic outlet, two fingers should be placed on the occiput and two fingers on the malar bones, or one finger in the mouth, and, the trunk being supported between the forearms, the chin should be rotated to the posterior pelvic wall.

(See Part X.) The trunk should not be twisted under any circumstances, in the hope of causing internal rotation of the head. Should the head remain in a transverse position in the upper portion of the pelvis, the head should be brought to the pelvic floor by suprapubic pressure and then the above procedure followed. That the life of the child may be saved the head must be born within five to ten minutes after the appearance of the umbilicus. Sometimes the placenta is detached too easily, likewise endangering the life of the child. Hence it is necessary to aid the birth of the head. If head flexion is not preserved, the chin will catch somewhere in the pelvis. The flexion should be maintained by firm continuous pressure on the fundus of the uterus. In case there is prolapse of the cord, the rapid delivery of the child is indicated. If the heart-beat is rapid or slow, speedy birth is imperative. If the leg or foot presents, it is easy to hurry the labor; but if the breech presents, the acceleration is more difficult. It can be done by passing the finger over the groin and making traction. Some claim that as soon as the diagnosis is made one should pull down one or both legs. One advantage of not doing so is that the breech is a better dilator of the cervix than is the body with the legs extended, and, generally speaking, it is better to leave the presentation as it is, for fear that leg traction might extend head and arms. The first stage of labor should be entirely finished before the second stage begins. We should not interfere without some positive indication. The forceps is seldom, if ever, required to deliver the after-coming head in breech presentation. (See Operations, Part X.)

FIRST SHOULDER POSITION.
LEFT SCAPULA ANTERIOR, L. SCAP. A.

FIG. 731.—AT THE PELVIC INLET.

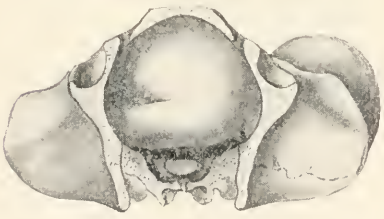

FIG. 732.—AT THE PELVIC INLET.

FIG. 733.—RIGHT SHOULDER IN THE CERVIX.

XI. SHOULDER PRESENTATION.

Synonyms: Trunk Presentation; Transverse Position; Cross-birth.

Definition.—Shoulder presentation is so named from the shoulder being the presenting part. An absolute transverse position exists when the long axis of the fetus forms a right angle with the long axis of the uterus, and is of rare occurrence. It is never present during labor. Any position of the fetus in which an angle exists between the fetal and uterine long axes is technically a transverse position, therefore oblique is really the proper term to designate the anomaly. Unless the obliquity is so slight that the ordinary head and breech positions are assumed spontaneously or through artificial aid during labor, a transverse or oblique position is virtually one in which the shoulder pre-

sents. These positions are, therefore, usually classified with respect to the special attitude of the shoulder. In shoulder presentation the shoulder almost invariably becomes anterior, and presents in the cervix or vagina at an early stage of the labor, since it is the most prominent and resistant part of the trunk. This is due to the contractions of the uterus at the beginning of labor, although it is conceivable, and even likely, that any of the numerous so-called trunk presentations should persist. Under the term shoulder presentation, then, we include all existing trunk presentations, such as dorsum, lateral plane, abdomen, thorax, neck, arm, elbow, or hand. The commonest form of shoulder presentation is the dorso-anterior, with the head to the left. Occasionally in this connection we have a compound presentation, such as hands and feet or feet and head. In all cases of shoulder presentation a wedge is formed, its base pointing upward, made of one of the long diameters of the head ($4\frac{1}{2}$ to $5\frac{1}{2}$ inches—11.43 to 13.97 cm.), and an oblique diameter of the trunk ($4\frac{3}{4}$ inches—12 cm.) occupying the lower uterine segment (Fig. 731). Labor consequently with a full-term child and a pelvis of average dimensions becomes impossible without either spontaneous or artificial correction of the malpresentation.

SECOND SHOULDER POSITION.
RIGHT SCAPULA ANTERIOR, R. SCAP. A.

FIG. 734.—AT THE PELVIC INLET.

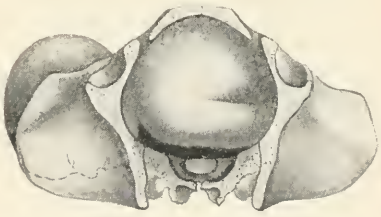

FIG. 735.—AT THE PELVIC INLET.

FIG. 736.—LEFT SHOULDER IN THE CERVIX.

Frequency. — The proportion of shoulder presentations as given by different statistics varies considerably. At one maternity the ratio may be 1 to 125 normal births, while at another it may not exceed 1 in 300. The proportion of primiparæ to multiparæ also varies, the former comprising 6 to 27 per cent. of the total. In 2200 cases of confinement I found shoulder presentation occurring in 12 cases, 0.54 per cent., or 1 in 183 cases.

Etiology.—This differs entirely with the parity of the woman. In primigravidæ the pelvis in shoulder presentations is usually contracted. As occasional contributory factors may be mentioned various conditions which predispose to faulty positions in general—hydramnios, monstrosities, malformation of the uterus, twins. In multigravidæ shoulder presentations often come about through relaxation of the abdominal walls, and especially in pendulous abdomen. The causes mentioned as obtaining in primigravidæ are also operative here to some extent. Unusual mobility of the fetus is another condition believed to favor the persistence of the oblique position. In the fetus immaturity—by reason of the weak muscles, the relatively large amount of liquor amnii, and the shape of the fetal ellipse in the premature fetus—

is the great cause of shoulder presentation. (Page 423.) Death and maceration of the fetus and multiple pregnancy for like reasons are causes. (Page 423.) In the parturient tract pelvic deformity, excessive pelvic obliquity, and excessive right lateral obliquity of the uterus are causes by interfering either with the proper attitude of the child or the ready engagement of the head in the pelvic inlet. For the same reason placenta prævia, lax abdominal walls, as in hanging belly, and an excessive amount of liquor amnii may result in shoulder presentation. This malpresentation is seven times more frequent in multigravidæ than in primigravidæ. Hydrocephalus or enlargement of the fetal head from any cause, since then it cannot engage in the pelvic inlet; fetal monstrosities and extreme mobility of the fetus from any cause; tumors of the pelvis or uterus, kyphotic spine and exostoses of the pelvic bones; tight lacing during pregnancy, which decreases the depth of the uterus while increasing the width; jars or traumatism of any kind—any one of these may offer cause for this faulty presentation.

THIRD SHOULDER POSITION.
RIGHT SCAPULA POSTERIOR, R. SCAP. P.

FIG. 737.—AT THE PELVIC INLET.

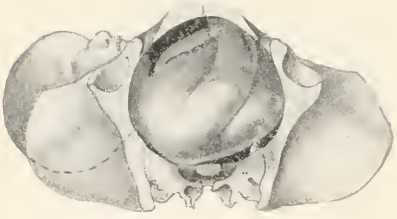

FIG. 738.—AT THE PELVIC INLET.

FIG. 739.—RIGHT SHOULDER IN THE CERVIX.

Positions and Relative Frequency.—Shoulder positions are named from the relation which a scapula—part of the fetus—bears to one of the four cardinal points of the pelvis. It should be remembered that right and left never refer to the scapulæ, but always to the right and left side of the pelvis; thus in the right scapula anterior we mean that the scapula is to the mother's right and anterior, no consideration being taken of the fact that the left scapula of the fetus presents.

I. Left scapula anterior, Scapula læva anterior, L. Scap. A. (Fig. 731).

II. Right scapula anterior, Scapula dextra anterior, R. Scap. A. (Fig. 734).

III. Right scapula posterior, Scapula dextra posterior, R. Scap. P. (Fig. 737).

IV. Left scapula posterior, Scapula læva posterior, L. Scap. P. (Fig. 740).

Left scapula anterior is the most frequent position.

Mechanism and Course of Labor.—We may say there is practically no mechanism of labor in shoulder presentation. It is safer to look upon labor as impossible without artificial aid than to trust to a spontaneous termination of the complication. The usual steps in unaided cases are impaction of the shoulder; ascension of the contraction ring; fetal death from prolonged pressure and maternal death from rupture of the uterus or exhaustion. While this is true, still under certain conditions a shoulder presentation has been known to terminate

spontaneously, in three ways, viz.: (1) Spontaneous rectification or spontaneous version; (2) spontaneous evolution; (3) doubled fetus, *partus conduplicato corpore.*

1. *Spontaneous Rectification and Version.*—The term spontaneous rectification is usually confined to instances in which the cephalic extremity of the fetus is brought into the lower uterine segment, and the term spontaneous version to those cases in which the breech is brought to the pelvic inlet. Spontaneous rectification is of frequent occurrence, and is often observed in the latter part of gestation or in the preparatory or first stage of labor. Spontaneous version is of less frequent occurrence, as the breech is not so frequently substituted for the shoulders at the pelvic inlet as is the head. The requirements for spontaneous version are a rigid fetus, viz., living and strong; irregular and strong uterine contractions, confined to the fundus, whereby the breech is driven down into the lower uterine segment. Spontaneous version is most apt to take place in multiparæ whose tissues are lax. After the bag of waters has ruptured, spontaneous version is seldom encountered, although the phenomenon is sometimes seen immediately after rupture before the amniotic fluid has escaped to any great extent. When the waters have mostly escaped, the tendency of the uterus is to grasp the fetus firmly, so that the shoulder presentation becomes confirmed. The opposite phenomenon is sometimes seen, in which a normal position of the child becomes transformed by uterine contractions into a shoulder presentation. These so-called secondary shoulder positions are of very infrequent occurrence. Spontaneous rectification and version are both probably due to uterine contractions, but another factor assists, such as the antero-lateral pressure of the patient's thighs as she sits or throws herself into certain postures, *e. g.*, kneeling or sitting. After spontaneous version or rectification has occurred, the mechanism is that of a head or breech presentation.

FOURTH SHOULDER POSITION.
LEFT SCAPULA POSTERIOR, L. SCAP. P.

FIG. 740.—AT THE PELVIC INLET.

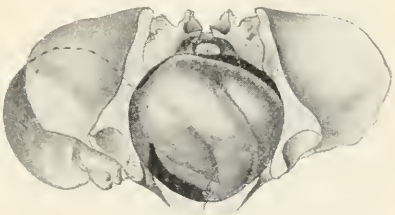

FIG. 741.—AT THE PELVIC INLET.

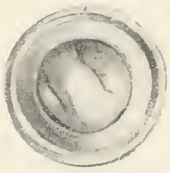

FIG. 742.—LEFT SHOULDER IN THE CERVIX.

2. *Spontaneous Evolution* (Fig. 543).—When a shoulder presentation becomes confirmed, a favorable termination of labor is still possible if the pelvis is ample, the pains are strong, and the fetus is small. In these cases the shoulder, forced into the pelvic inlet, follows the general law of rotation and turns forward. It then comes to lie beneath the symphysis, the two fetal poles being closely approximated. The shoulder is followed by the subjoined half of the thorax, the

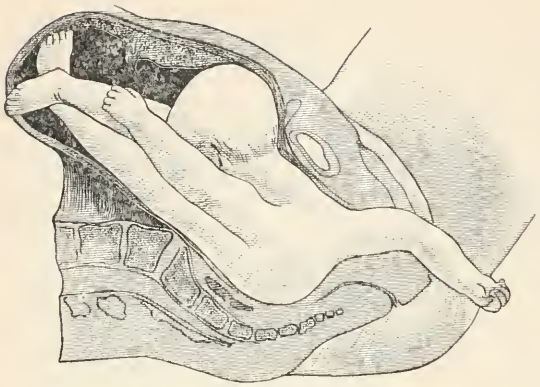

FIG. 743.

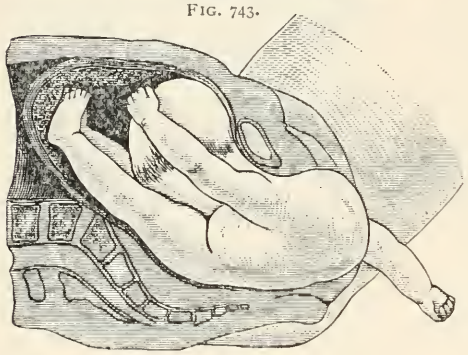

FIG. 744.

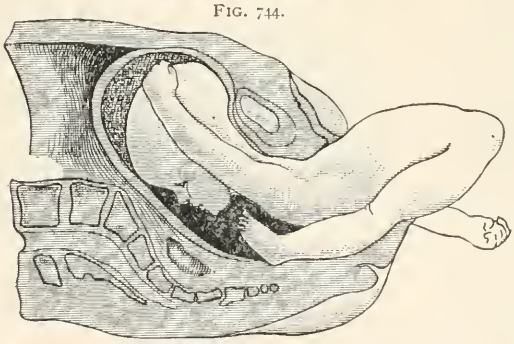

FIG. 745.

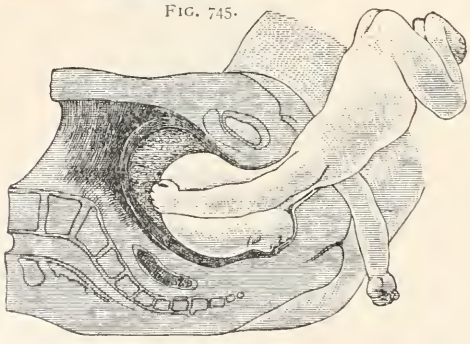

FIG. 746.

FIGS. 743 TO 746.—THE FOUR STAGES OF SPONTANEOUS EVOLUTION.

buttocks, the opposite shoulder, and finally the head. This process may require but very little time, and even a solitary contraction is known to have been sufficient. This spontaneous termination of shoulder presentation occurs in about 8 per cent. of all cases if unusually small children, second twins, premature births, etc., are included. In a series of immature living children the proportion is still higher, and some authors do not even class these deliveries as pathological. The stages, then, in the accomplishment of spontaneous evolution are: (1) compression of the fetus; (2) descent (Fig. 743); (3) engagement of the anterior shoulder under the pubic arch (Fig. 744); (4) driving out of the podalic extremity of the fetus over the posterior wall of the parturient tract (Fig. 745); (5) delivery of the posterior shoulder and arm (Fig. 745); (6) delivery of the after-coming head (Fig. 746). Excessive lateral flexion of the fetus is necessary for the accomplishment of spontaneous evolution. Unless all conditions are most favorable for birth, the case will end in fetal impaction and death of the fetus.

3. *Doubled Fetus* (*Partus Conduplicato Corpore*).—When spontaneous evolution occurs in very small yielding fetuses, the approximated head and buttocks may pass through the pelvis side by side, rotation failing to occur. This so-called *partus conduplicato corpore* is extremely rare. The fetus's head and body together enter the pelvis with the prolapsed shoulder in advance. There should be rotation of this shoulder to the pubic arch, but the mechanism of this process is scarcely noticeable, since if it is possible for it to take

place at all, the fetus must be very soft and small. In this process the head and body are delivered together, followed by buttocks and legs, the second arm lying between the head and breech. The conditions necessary for delivery by a doubled fetus are a roomy pelvis and a small, macerated, dead or premature fetus. It is an extremely rare termination.

The preceding terminations of shoulder presentation are exceptional, and in the great majority of cases nature is unequal to the task of expelling the fetus. If labor in a shoulder presentation begins with weak pains and early rupture of the membranes, the contractions remaining feeble after the latter event, such a state of affairs may persist for days until the cervix is fully dilated. Or we may sometimes see rupture of the membranes followed by violent contractions which cause rupture of the lower segment of the uterus within a few hours. Under any circumstances the long sojourn of the fetus in the maternal passages, often inevitable in shoulder presentation, is frequently followed by maceration, especially when death has occurred early in labor. Maceration, by rendering the child more compressible, is sometimes the occasion of spontaneous ending of labor.

FIG. 747.—FROZEN SECTION OF A NEGLECTED SHOULDER PRESENTATION. Woman died in the second stage of labor. Shows first stage of spontaneous evolution.—(*Chiara.*)

Diagnosis.—Before labor abdominal palpation usually renders the diagnosis simple. During labor we find the cervix high up in the pelvis and irregular formation of the bag of membranes. When uncertainty exists, one must administer chloroform and pass the whole hand into the vagina to make a positive diagnosis. The shoulder is to be differentiated from the breech (page 536); the elbow from the knee (page 536); the hand from the foot (page 536). Inspection alone will often reveal the nature of the case, as the transverse diameter of the uterus exceeds the longitudinal and the outline is not symmetrical. As a rule, the fetal back lies anterior. Then the round, hard head can be felt in one iliac fossa and the soft, irregular breech in the opposite side of the mother's abdomen high up (Fig. 201). The line of the back may be traced between the two. These points may be observed before labor or in its early stage. But at a more advanced stage, as lateral flexion of the child increases, the head would almost appear to join the breech at a right angle. When the resisting back lies posterior, it cannot be felt by palpation. By vaginal

FIG. 748.—NEGLECTED SHOULDER PRESENTATION. LEFT SCAPULO-ANTERIOR POSITION. Death of fetus and œdema and excoriation of the right shoulder.—(*Schaeffer.*)

examination the dependent part of the bag of waters gives a sensation often likened to that of a glove-finger; the head cannot be felt; if the shoulder presents, its rounded contour may be felt as well as the axillary fossa; the ribs may be traced near at hand and also the acromion, clavicle, and scapular spine.

	Position of Fetus.	Position of Fetal Heart-sounds.
Left Scap.-anterior. L.Scap.A.	Head in left iliac fossa, back anterior; extremities on right side, in upper part of abdomen.	Left side of abdomen, below umbilicus.
Right Scap.-anterior. R. Scap. A.	Head in right iliac fossa, back anterior; extremities on left side, in upper part of abdomen.	Right side of abdomen, below umbilicus.
Right Scap.-posterior. R. Scap. P.	Head in right iliac fossa, back posterior; extremities on left side, in upper part of abdomen.	Right side of abdomen, below umbilicus toward the rear.
Left Scap.-posterior. L. Scap. P.	Head in left iliac fossa, back posterior; extremities on right side, in upper part of abdomen.	Frequently cannot be heard. Left side to the rear.

Prognosis.—In cases left to themselves the prognosis is grave for both mother and child. With intervention, the outlook varies with the stage of labor and other factors. If the case is seen early, the position may be transformed from the oblique to the vertical, especially if the bag of waters is intact; while if the latter can be preserved until the cervix is fully dilated, there is a good chance of extracting the child alive. The outlook for the mother is prejudiced only by the added danger from atonia, hemorrhage, and infection from manipulations. It must be remembered, however, that rupture of the uterus may occur during the performance of embryotomy. The prognosis will depend on the operation undertaken, since natural termination of shoulder presentation is not the rule. When the presentation is rectified early, there is a good outlook for mother and child. Neglected cases will result in death of both. Dangers to the child come from compression of the brain centers, vessels of the neck, or umbilical cord. Injury of the child is liable to occur during operation. The mother may die of sepsis, exhaustion, rupture of the uterus, or hemorrhage. *Conclusions:* The prognosis depends upon: (1) the stage of labor at which the complication is recognized; (2) the time that elapses before the correction of the malpresentation; (3) the time that has elapsed since the membranes ruptured, and the quantity of liquor amnii still remaining in the uterus; (4) the condition of the uterus and cervix, especially as regards thinning of the lower uterine segment, and ascent of the contraction ring; (5) prolapse of the cord as a complication. A neglected shoulder presentation results in a gradual escape of all the liquor amnii, contraction and retraction, a tetanic or inert condition of the uterus with or without uterine rupture, exhaustion and death of both mother and fetus.

Treatment.—All delay is dangerous, and the sooner the malpresentation is corrected by external, combined, or internal version, the better the prognosis. If the shoulder is already impacted, decapitation of the fetus must be performed or some other method of removing the child should be undertaken at once. Laparotomy, with the Cæsarean or Porro operation, is certainly safer in many neglected cases than a difficult decapitation. (See Part X.)

FETAL DYSTOCIA FROM FAULTY POSITION.

XII. PERSISTENT OCCIPITO-POSTERIOR POSITION.

Definition.—The vertex presentation in which backward rotation of the occiput occurs in the first and second positions or in which a permanent occipito-posterior position obtains in the third and fourth positions. As a rule, labor is prolonged in these cases, partly because the head does not flex as it ought to on its entrance into the pelvis, and consequently does not readily descend, and partly on account of the protracted internal rotation (Fig. 750).

Frequency.—This is variously stated as from 1 to 4 per cent. In 2200 labors I found that persistent occipito-posterior position occurred in 89 cases, or 4.04 per cent.; 46, or 51.68 per cent., were in primiparæ; 33, or 37.07 per cent., in multiparæ; and 10. or 11.23 per cent., were of unknown para.

Etiology.—The most common cause is incomplete flexion of the head whereby some other part of the head, such as the forehead, first meets the resistance of the pelvic floor, and is deflected anteriorly. This throws the occiput into the hollow of the sacrum. In other cases the cause may be found in a defect in the resistance of the pelvic floor, as in the birth of the second twin when the pelvic floor has been stretched by the birth of the first; in old and extensive lacerations of the pelvic floor; in disproportion between the head and floor, as in very roomy pelves, or in undersized heads; in uterine and abdominal inertia; in obstruction to forward rotation of the vertex, as in prolapse of the hand or foot anteriorly; in pelvic deformity, as in justo-minor or kyphotic pelves; or in hydrocephalus of the fetal head. In these cases accommodation or adaptation results in a posterior position of the vertex. Sometimes in cases in which there is a slight disturbance of flexion and the occiput first touches the floor, there is rotation backward of the occiput because the fronto-occipital diameter engages and it is impossible for the head to rotate from one oblique diameter through the shorter transverse to the other oblique.

Mechanism.—(Compare Vertex Presentation, Part IV.) To understand the mechanism of labor, careful comparison must be made between the lower anterior and posterior wall of the parturient tract. The anterior wall of the pelvis, namely, the symphysis, is 1½ inches (3.81 cm.) to 2 inches (5.08 cm.). The distance from the junction of the neck with the trunk to the vertex is about 3 inches (7.62 cm.) hence in occipito-anterior position the head reaches the pelvic floor and extends through the vulval orifice without the trunk necessarily entering the pelvis until the head is completely delivered. The posterior wall of the pelvis, from promontory of sacrum to coccyx, is 5 inches (12.7 cm.), and the pelvic floor, when distended, from coccyx to edge of perineum is also 5 inches (12.7 cm.), making 10 inches (25.4 cm.) from promontory to perineum. Hence for the vertex to reach the pelvic floor in the posterior position the neck must be greatly elongated or the trunk must enter the pelvis with the head. If the latter occurs, subsequent impaction is liable to take place, for we will then have at the pelvic outlet a presenting part whose antero-posterior diameter is made up of the fronto-mental diameter of the fetal head (3¼ inches —8.25 cm.) and the dorso-sternal diameter of the fetal trunk (3¾ inches—9.5 cm.), making together 7 inches (17.78 cm.) to pass through the lower part of the pelvis (Fig. 750). In spite of the foregoing, spontaneous termination sometimes occurs. The brow engages under the symphysis; the perineum, tremendously distended, retracts over the occiput; the latter, in an extreme state of flexion, sometimes with an entire loss of perineum

and anterior rectal wall, extends and is born. The nape of the neck then rests upon the retracted and lacerated perineum and the supraorbital ridges, eyes, nose, and mouth appear under the symphysis and the head is born by extension. Persistent occipito-posterior position is also known as "face to pubis." When natural expulsion takes place, as has been said, the face passes under the symphysis and the occiput makes its way over the perineum. This process is not an easy one and necessitates vigorous contractions, lax maternal soft parts, and head of ordinary size. The head moulding results in very much shorter occipito-frontal and occipito-mental diameters with corresponding lengthening of the suboccipito-bregmatic (Fig. 752). Before passing through the outlet the head becomes well flexed. After the head is born external rotation (internal rotation of the shoulders) occurs, after which the body is born. If flexion be prevented, the head may rarely come down into the pelvis in a state of extension and there exists a brow or face presentation. Or, again, the head only partially flexed may enter the pelvis, and after reaching the floor there may be partial rotation and the head become fixed in the transverse diameter of the cavity of the pelvis (Deep Transverse Position of the Head, page 553.)

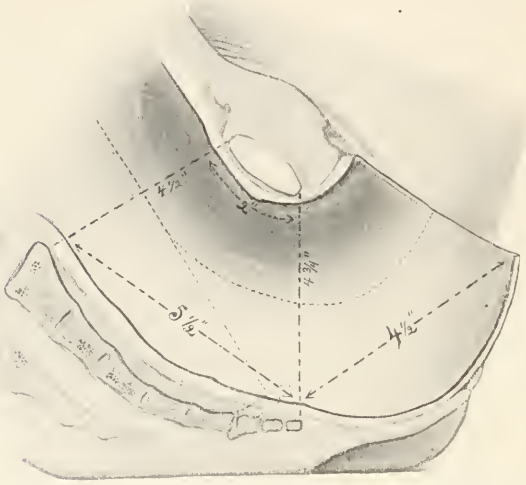

FIG. 749.—DIAGRAM EXPLANATORY OF THE MECHANISM OF PERSISTENT OCCIPITO-POSTERIOR POSITION OF THE VERTEX.

Diagnosis.—In palpation of the maternal abdomen at the beginning of labor the fetal limbs but not the back may be felt, especially if the parietes are lax and thin, and the head may be perceptible above the brim. The heart-sounds are heard between the ribs and the crest of the ilium. By vaginal examination the head may be felt through the fornices, and later on, when the cervix is sufficiently dilated, the posterior fontanelle is in the posterior part of the pelvic cavity, while the sagittal suture is in the line of an oblique diameter. In the first stage the pains are not infrequently irregular and abnormal.

FIG. 750.—PERSISTENT OCCIPITO-POSTERIOR POSITION.

Prognosis.—The dangers to the mother are prolonged labor, exhaustion, and even death. Severe lacerations of the pelvic floor are the rule. In impaction pressure necrosis, sepsis, and shock of operation may occur. The mortality for the child is about 10 per cent. The dangers are: asphyxia from prolonged com-

pression or premature separation of the placenta; cerebral compression, and pressure on the cord.

In my 89 cases already referred to, the maternal mortality was 3 cases, or 3.38 per cent. Regarding the fetal prognosis, 79, or 88.76 per cent., lived; 7, or 7.86 per cent., were still-born; and the result for 3, or 3.38 per cent., was not recorded. In the 89 cases referred to above, the method of delivery was by natural forces in 43 cases; forceps in 41; version in 2; craniotomy in 1 case, and symphyseotomy in 1 case.

HEAD MOULDING IN PERSISTENT OCCIPITO-POSTERIOR POSITION.

FIG. 751.—BEFORE MOULDING.

FIG. 752.—AFTER MOULDING. Note depression at anterior fontanelle caused by the pubic arch.

Treatment. — *Prophylactic:* The preventive treatment of this quite common and serious complication of labor promises very little indeed, because we are unable to remedy the anatomical cause of the condition found in the fetus, pelvis, or maternal soft parts. When the diagnosis of occipito-posterior position is made in pregnancy, it has been proposed that the more favorable anterior position shall be obtained by external manipulation through the anterior abdominal wall. This is a refinement of abdominal palpation which I believe to be theoretical in the hands of most, if not all, obstetricians. Postural prophylaxis, on the other hand, I believe offers some hope in cases in which the anatomical influences in fetus, pelvis, or maternal soft parts are not too strong. In instances in which there is reason to suspect this complication the patient may be instructed to assume the knee-elbow position for five or six minutes morning and evening for a fortnight or even longer preceding labor.* This to be followed by the lateral posture. I have found in private practice that it is often a physical impossibility for patients to remain more than a minute or two in the knee-chest position by reason of the intense cerebral congestion and discomfort produced. In such a case in the latter part of pregnancy and during the first and second stages of labor I have the woman placed in an exaggerated lateral prone position with a pillow or several sheets under the lower buttock in order, as far as possible, to reverse the condition of the dorsal position. The choice of side for the patient to lie upon is the one toward which the occiput points. (See

* Reynolds: "Practical Midwifery," page 211, 1892.

Operations, Part X.) *Operative:* It should be clearly understood that operative interference in occipito-posterior position is not to be undertaken until labor has advanced to a point at which the interests of fetus or mother demand intervention. It must be remembered that operation is applicable only to persistent cases of this kind; that most of the originally occipito-posterior positions terminate anteriorly spontaneously, and that only between one and four per cent. of all vertex positions result in persistent posterior positions, the remaining being either originally anterior positions or terminating spontaneously as such. Before deciding upon interference in all cases of delayed labor at the pelvic inlet I always make a thorough examination under chloroform, introducing the whole hand if necessary to ascertain the presentation and position, and secure flexion or extension as the case may be. For convenience' sake I am accustomed to divide all of these cases into three classes: (1) High cases, in which the vertex is still above the pelvic inlet and not engaged; (2) medium, in which the vertex is fully engaged but occupies the upper part of the pelvis and has not reached the pelvic floor; (3) low cases, in which the occiput rests on the pelvic floor and possibly distends the perineum.

FIG. 753.—PERSISTENT OCCIPITO-POSTERIOR POSITION OF THE HEAD. R. O. P. Prolonged labor; secondary inertia; rest; strychnia; spontaneous delivery with anterior rotation of the occiput.—(*From a tracing. Emergency Hospital, October* 7, 1892.)

1. *High Cases.*—This is the most infrequent of the three classes, for in the majority of cases the natural powers possess strength enough to engage the head, and only subsequently, by reason of the malposition and excessive force required, do the powers fail. Fortunate it is that this is the case, since this class carries with it the worst prognosis under operative treatment. No serious disproportion existing between the fetus and pelvis, we have at our command four procedures for the management of these cases: (1) Rotation of the back of the fetal ellipse to the front by external manipulation, followed by the application of the forceps; (2) rotation of the vertex from the posterior to the anterior position by internal manual means, followed by the use of the forceps; (3) the application of the forceps without previous attempts at anterior rotation of the occiput; (4) internal podalic version followed by breech extraction. (1) *External manual rotation:* The possibility under favorable conditions—namely, intact membranes and thin abdominal walls—of rotation of the occiput forward by external manipulation must be granted, but such a theoretical refinement of obstetrical palpation can scarcely be of much practical value. (2) *Internal manual rotation:* Anterior rotation of the occiput by means of the hand passed into the uterus and grasping the head or shoulders and allowing the anterior position to terminate spontaneously, or delivering immediately with the forceps, is the favorite treatment with many operators in

America and by some used to the exclusion of other methods of treatment. I have been more successful with other methods, and I am convinced after repeated trials that the mortality with this method equals that of internal podalic version, for the reason that successfully to carry out the anterior rotation the hand must be used not only to rotate the head, else it will immediately return to its malposition, but it must be passed up to rotate the shoulders as well. This grasping of the fetal body I have found disturbs the circulatory equilibrium of the fetus, favors intrauterine asphyxia, and, unless the fetus is immediately extracted, intrauterine death ensues. Should this method of correction be selected, it should always be performed bimanually, one hand upon the anterior abdominal wall assisting in the work of the internal hand. The operation can often be more readily performed with the patient in the exaggerated left lateral prone posture, and lying upon that side of the pelvis around the segment of which we desire the occiput to rotate. (See Part X.) If the fetal back and occiput are directly to the rear, and there is thus no choice of sides for the patient to lie on, the exaggerated left lateral prone posture will be found the most convenient for permitting the use of the right hand internally. (3) *Forceps:* The application of the forceps without previous attempts at anterior rotation of the occiput. Both theoretically and practically I believe this method will give better results as far as fetal mortality and morbidity are concerned, and equally as good results for the mother as version. The difficulties and dangers of a high forceps operation in this as in other presentations and positions must ever be kept in mind, and so great are these dangers that I would recommend this method of treatment only to those thoroughly familiar with the technique of a high forceps operation. For those of limited experience in high forceps operations version will prove the safer operation for the mother, although carrying with it a high fetal mortality. Of course, the usual contraindications for version always hold good—namely, escape of the liquor amnii, tetanic uterine contractions, and dangerous thinning of the lower uterine segment. It is in these cases particularly that no æsthetic reason should prevent our perforating the head of a dead fetus. Usually it is not wise to attempt an adaptation of the forceps under such conditions to the sides of the fetal head,—namely, the cephalic application,—but to apply the instrument at the sides of the pelvis—namely, the pelvic application. My object in the use of the forceps in these cases is to change a high occipito-posterior position into a medium or low one, then to remove the forceps, which has perhaps grasped the head obliquely, adapt it over the fetal ears, use the instrument as a rotator, and instrumentally rotate the vertex to the front as in medium and low cases. (See Operations, Part X.) (4) *Version:* Manual anterior rotation or forceps without manual rotation failing and the fetus being still alive, version remains as the only alternative. I place version last because I believe the forceps alone or combined with manual rotation offers the best prognosis in the hands of the experienced operator. If by reason of uterine retraction version is forbidden, perforation and possibly symphyseotomy should be considered.

2. *Medium Cases.*—As in high cases of persistent occipito-posterior positions, the first step in the treatment is to insure complete flexion of the head. Anterior rotation may be promoted by pressure upon the forehead applied during a pain. This pressure should be applied as far forward as possible. If the head becomes extended, it may be flexed by pushing up the forehead or pulling down the occiput. For the latter purpose a vectis or blade of the forceps may be used if there is no room for the hand. If the expulsive force is at

fault, the judicious use of remedies for delay in the second stage may be employed (page 573). If all efforts at rotation fail and immediate delivery is demanded, the application of the forceps is the only resource, short of perforation. (For the use of the forceps in occiput posterior positions see Operations, Part X.)

3. *Low Cases.*—This I have found to be the most frequent variety of occipito-posterior cases met with. The forces are able to push the fetal head to the pelvic floor, and then delayed labor ensues by reason of the fact that the forceps is unable either to rotate the occiput anteriorly or to deliver the head of the occiput remaining at the rear. Whether the case be a left or right sacro-position, two methods of delivery in the case of a living fetus are open to us. These are (1) forceps delivery with the occiput still posterior; and (2) rotation of the occiput anteriorly with the forceps and delivery as in anterior positions of the vertex. In all cases with the exception of a few multiparæ with lacerated and relaxed pelvic floors in which little resistance to delivery is offered I would advise the second plan of procedure.—namely, anterior rotation of the occiput with the forceps,—for the reasons that less laceration of the pelvic floor occurs, and the fetal morbidity and mortality are less in mechanical anterior rotation and delivery. Much bitter opposition to instrumental rotation of the presenting part has been expressed by English and American obstetric writers, notably Playfair,* Lusk,† Hirst,‡ and Reynolds§; the French and German writers taking a more liberal view of the question. Since the early nineties I have been teaching and using instrumental rotation in these cases in both hospital and private work, and, with certain limitations, have never had occasion to regret it. A paper by Brodhead,‖ of New York, read before the New York Obstetrical Society, brought out in the discussion that the method, in New York at least, was coming into general favor; Cragin, Tucker, Marx, Von Ramdohr, and I indorsing the operation. (See Operations, Part X.)

XIII. PERSISTENT MENTO-POSTERIOR POSITION.

Definition.—A face presentation in which backward rotation of the chin occurs in the first and second positions, or in which a persistent mento-posterior position obtains in the third and fourth positions (Fig. 756).

Frequency.—Face positions in the pelvic cavity with the chin persistently behind are rare; their existence has even been denied. They make up less than one per cent. of all face positions.

Etiology.—(1) The face may engage at the inlet with the chin behind and anterior rotation may not take place; (2) or, with the chin in front, posterior rotation occurs. In the first case the failure of anterior rotation is due to the relative disproportion between the depth of the excavation at the side and the length of the fetal neck, so that the chin does not meet with sufficient resistance to produce anterior rotation. Certain pelvic deformities or obstructive conditions of the soft parts might produce the same results. The prominence of the bregmatic region in consideration of the distance it must travel in rotation renders necessary the presence of strong, persistent uterine contractions and capacity of the head for moulding. The second variety can occur only with a very large pelvis or small head; the head is imperfectly extended, the sinciput meets with the pelvic-floor resistance before the chin and is turned forward, carrying the chin backward. In

* "Science and Practice of Midwifery," 1898.
† "The Science and Art of Midwifery," 1892.
‡ "Text-book of Obstetrics," 1898.
§ "Practice of Midwifery," 1896.
‖ "American Journal of Obstetrics," vol. XLII, No. 6, 1900.

the case of a very small fetal head or justo-major pelvis the face may be forced into the pelvis with extension incomplete. The sinciput strikes the pelvic floor in advance of the chin. If the chin is behind in the inlet, it remains behind; if in front, the sinciput strikes the sacral segment of the pelvic floor and rotates forward, carrying the chin backward.

Mechanism.—To understand these unreduced mento-posterior positions we must bear in mind the mechanism of normal posterior face positions. These presuppose the existence of complete head extension by virtue of which the chin is first to strike the pelvic floor and be rotated beneath the pubis. When the etiological elements already enumerated come into play so that the chin finds its way to the hollow of the sacrum, the head, neck, and thorax constitute a wedge which with further progress of labor becomes impacted. The almost unanimous testimony of obstetricians is that birth of living mature children in mento-posterior positions is necessarily impossible. Ahlfeld states that a few cases of undoubted authenticity are on record, but does not state how such births were made possible. The mechanism of this position in relation to its essential fatality may be summarized as follows: Spontaneous expulsion is impossible without partial or complete rotation of the chin forward; the length of the fetal neck from the trunk to the chin is about 2 inches (5.08 cm.); the posterior wall of the parturient canal from the promontory to the edge of the perineum is 10 inches (25.4 cm.); the chin cannot reach the perineum without entrance of the thorax into the pelvis; impaction results because the trachelo-bregmatic diameter of the head, and dorso-sternal diameter of the thorax, each of which measures 3½ inches (8.89 cm.). or 7 inches (17.78 cm.) in all. attempt to pass into the pelvis at once. Naturally all the phenomena of obstructed labor result, including tetanoid contractions of the uterus. The fetus perishes from asphyxia as a consequence of compression of its head and chest. These unreduced mento-posterior positions are often compared with those in which the occiput does not undergo anterior rotation. In the occipito-posterior variety the occiput clears the perineum and frees the head; but in the mento-posterior the large fontanelle is pressed against the pubis, and for the chin to clear the perineum a degree of extension would be required which is impossible for a living, full-sized fetus (Fig. 756).

FIG. 754.—MOULDING OF THE HEAD IN FACE PRESENTATION. Primipara; R. M. P.; first stage of labor three days; membranes ruptured two days; uterine inertia; manual dilatation of cervix; adaptation of forceps. Fronto-mental diameter transverse in the pelvis; rotation with the forceps; delivery of a living child.—(*Author's case at Emergency Hospital. December* 8, 1902. *From a tracing.*)

Diagnosis.—In a mento-posterior position the occiput is found more toward the front in the anterior and lower part of the uterus, palpable and visible from the outside. Internally the vaginal vault appears flat and the chin stands high and is difficult to reach posteriorly. The fetal cardiac sounds are heard with difficulty. With the entire hand in the vagina the diagnosis is not difficult.

Prognosis.—This position is universally recognized as forming the most

serious mechanical complication of labor arising from the fetus. The child mortality is about 50 per cent. C. B. Reed* collected 75 of these cases from literature and found the maternal mortality 11.6 per cent. or about the maternal mortality of placenta prævia. The fetal mortality in the 75 collected cases was 40.6 per cent. This series includes both persistent cases at the inlet and outlet and several small children. Persistent cases with the chin embedded in the pelvic floor with a full-sized child give a fetal mortality of practically 100 per cent. The mother is exposed to great danger and the mortality is high.

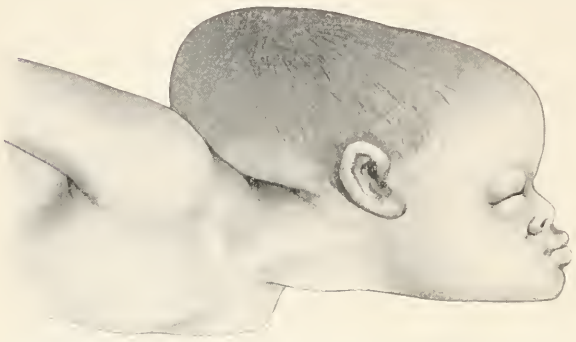

FIG. 755.—MOULDING FROM PERSISTENT MENTO-POSTERIOR POSITION. R. M. P.; prolonged labor; secondary inertia; strychnia; spontaneous delivery with anterior rotation of the chin.—(*Author's case at the Emergency Hospital, April, 1902.*)

Treatment.—1. *At the Pelvic Inlet.*—We must remember that less than 1 per cent. of all face presentations are persistent mento-posterior, hence the value of expectancy within safe limits. Defective extension should be corrected by the fingers or hand. Failure of engagement of the face at the inlet calls for conversion into a vertex by Baudelocque's, Thom's, or Schatz-Thom's methods, followed by high forceps or spontaneous labor in posterior chin positions, and podalic version and extraction in anterior chin positions, or conversion and high forceps in both. In multiparæ I prefer podalic version and extraction to the exclusion of other combined methods.

2. *In the Pelvic Cavity.*—Application of the hand or forceps blade beneath the chin will give the latter a point of support which will favor anterior rotation. Traction with forceps will bring the chin upon the pelvic floor and slight rotation will enable it to rotate forward. No attempt should ever be made to deliver the chin over the perineum. When the face is impacted, the indication must lie between forceps for rotation, symphyseotomy, Cæsarean section, and embryotomy. The original teaching of Scanzoni and others that forceps might be used to turn the chin forward is now almost universally condemned. Popescule †

FIG. 756.—PERSISTENT MENTO-POSTERIOR POSITION.

* "Amer. Jour. Obstet.," vol. LI, No. 5, 1905.
† "Centralbl. f. Gynäkol.," Aug. 4, 1900.

followed this advice and lost the mother. He states that he would never use the forceps in another case. Von Braun states that the use of the forceps for this complication means death for mother and child. Döderlein appears to think that great technical skill might accomplish something with the forceps. I have repeatedly used the forceps successfully as rotators of the chin anteriorly when the chin had not become embedded in the pelvic floor, and when it did not point directly posteriorly. Popescule first brought the face into the transverse position. He then detached the blades, reapplied them, turned the chin under the symphysis, and extracted the child. In the past most authorities agreed that perforation is the indication of necessity, even in the living child. Symphyseotomy has been suggested as applicable to this complication. It has been once performed.*

XIV. TRANSVERSE POSITION OF THE HEAD AT THE PELVIC OUTLET.

Definition and Etiology.—Descent of the head occurs without anterior rotation in consequence of certain anomalies of the pelvis or fetus. This is the "deep transverse position" of the head. This position is primary or secondary. The *primary position* is found in the simple flat pelvis, in the generally contracted flat pelvis, and in the masculine or funnel-shaped pelvis, and even in the larger pelves when the head is very small and the liquor amnii suddenly lost with precipitate descent of the head. It is also found in congenital double hip dislocation. In the simple flat pelvis the bregma is lower, while in the generally contracted flat pelvis the posterior fontanelle is lower. Nearly all of these cases when analyzed show themselves to be occipito-anterior presentations. The *secondary position* is found when the head is large and the occiput is broad, as in dolichocephalus. The occiput continues posterior from the first till the head reaches the floor of the pelvis. At this point there may occur a partial rotation of the occiput into the transverse diameter of the outlet. The bregma is generally lower than the occiput. Incomplete head flexion is a common cause. Again, this position may occur in case of a flat pelvis which is large enough to let the head pass the inlet in an oblique diameter, the occiput being posterior, but which is so contracted below that anterior rotation cannot completely take place as in the masculine pelvis. Reed found 32 deep transverse arrests of the head in 3600 labors at the Chicago Lying-in Hospital, or 0.9 per cent.; 18 cases occurred in multiparæ and 14 in primiparæ (Fig. 757).

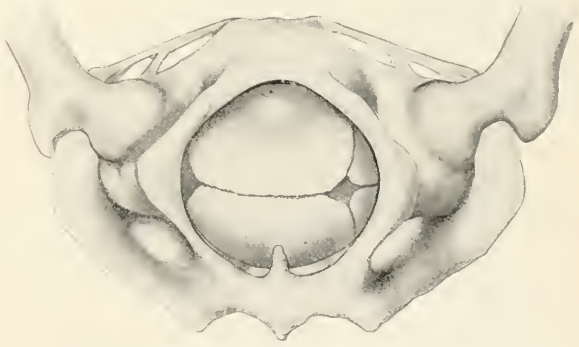

FIG. 757.—TRANSVERSE POSITION OF THE HEAD AT THE PELVIC OUTLET. DEEP TRANSVERSE POSITION OF THE HEAD.

Symptoms.—If the head remains in this position, pressure necrosis, fistula, and death of the fetus and mother may occur. The head may be born transversely, causing extensive laceration, or anterior or posterior rotation may take

* Montgomery: "Trans. Ill. Med. Soc.," 1904.

place. In some cases the pains may entirely cease owing to the obstruction to labor. In others, the head may be forced through the bony outlet by the excessive strength of the pains, and the perineal tissue then suffers. Spontaneous transverse delivery may rarely occur in the case of a large pelvis, a small head, and an old perineal laceration. Cases are known in which the head if it continues in extreme flexion is born transversely in a flat and contracted pelvis.

Prognosis.—For the mother, delayed labor, exhaustion, and sepsis; for the fetus, asphyxia or death from compression of the brain or placenta.

Treatment.—Postural treatment offers very little. Anterior rotation may be favored by the lateral decubitus, the patient lying on the side toward which the occiput faces. (See Posture in Obstetrics, Part X.) Stimulants, such as strychnin, quinin, and alcohol, may be administered to increase the expulsive forces. Digital rotation with the hope of bringing the occiput forward may be tried, but will hardly succeed in contracted pelves: (1) With two fingers in the vagina we may attempt to push the sinciput posteriorly; (2) with two fingers or the whole hand in the vagina we may lift up the head slightly and with two fingers of the other hand in the rectum attempt to push the brow backward; (3) with the whole hand in the vagina grasping the vault of the head, we may attempt both to raise the head from between the tubera ischii and at the same time rotate the occiput anteriorly. Failing with manual correction, the forceps may be applied over the parietal bones; and failing in this, in an oblique pelvic diameter and rotation combined with traction used. Symphyseotomy has its place in firm impaction and a living fetus. In all cases of impaction with a dead fetus the head should be perforated.

FETAL DYSTOCIA FROM GENERAL FETAL CONDITIONS.

XV. MULTIPLE BIRTH.

Definition.—The birth of two, three, or more normal fetuses. Monsters are not included under this head.

Frequency.—The proportion of multiple to single births varies considerably in different countries. The ratio of triple, twin, and ordinary labors in Germany is given by Strassmann as 1 : 89 : 7921. It is of interest to note that in this series the number of twin pregnancies is exactly the square root of the number of single births. For the etiology see page 140.

Symptoms.—The course of multiple delivery is often short. After one fetus is expelled the uterus is quiescent for a certain period; upon an average, for half an hour. Instead of this physiological repose, however, prolonged inertia may develop. In such cases the second child may be in a transverse position, and in any case the second membranous sac should be ruptured at the expiration of half an hour. The cervix being fully dilated and the cord of the first fetus still connected with the placenta, the chances for intrauterine infection are considerable. The fetal presentations run as follows in twin labors: the commonest form is the double vertex (Fig. 762); next, the fetus to be born first presents by the head, the other by the breech (Fig. 764); third, the first fetus presents by the breech, the second by the head; fourth, a head and a shoulder presentation are associated, the first child usually presenting by the head. Two shoulder presentations occur infrequently (Fig. 761), while two pelvic presentations are very exceptional. Averaging a large number of presenting parts in multiple births it is found that about 54 per cent. are cephalic, about 32 per cent.

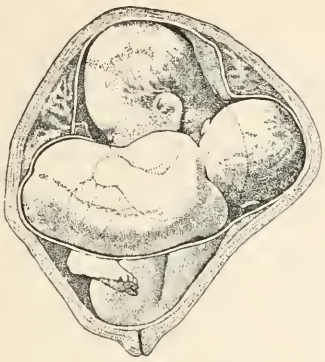

FIG. 758.

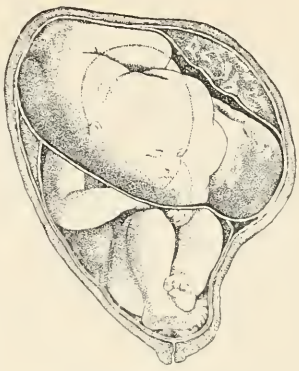

FIG. 759.

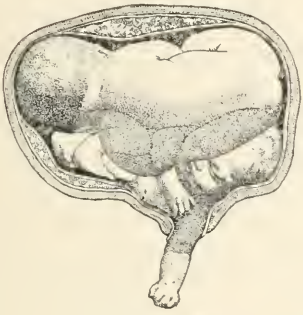

FIG. 760.

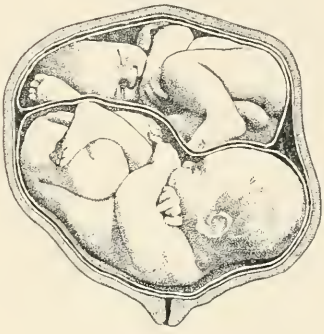

FIG. 761.

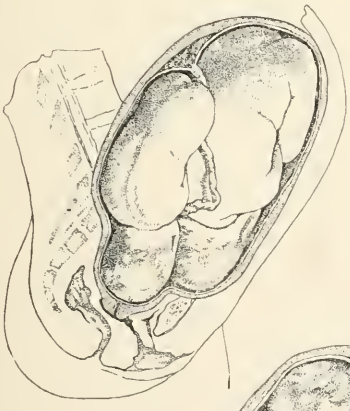

FIG. 762.

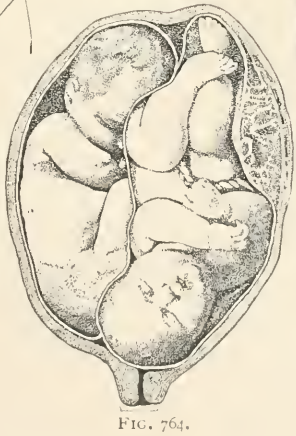

FIG. 764.

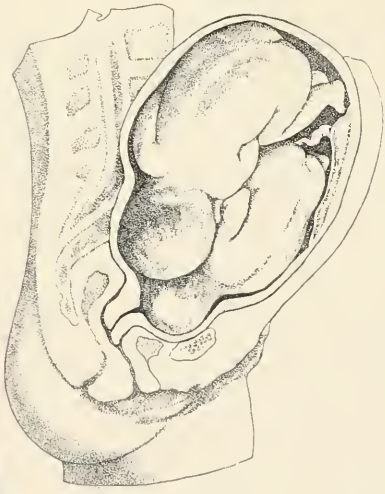

FIG. 763.

FIGS. 758 TO 764.—PRESENTATIONS IN TWIN DELIVERIES. — (*After Dickinson.*)

pelvic, while the remainder are shoulder. About three-fifths of the heads are in the first, the remainder in the second cranial positions. It very seldom occurs that both heads are in the same positions. As a rule, the fetuses are face to face, and the one on the left side is born first, the right coming after in the second cranial position. If the fetuses are placed one behind the other, the heads should be in the same position. In regard to abnormal presentation in twin pregnancy, bregma, brow, and face positions occur more frequently than with single births, comprising not less than 10 per cent. of cephalic births. Bregma presentation is probably increased because of the diminished prominence of the frontal region in twins, which reduces the resistance encountered at the pelvic inlet. As a rule, brow and face presentations run a more favorable course than in single labors. (For *diagnosis* and *prognosis* see page 143.)

Management of Twin Labors.—In the case of abortion of one twin it was once the practice to attempt retention of the second, and successes have been reported. To-day it is the uniform practice to bring away the sound fetus with its dead fellow, for the chance of saving life does not compensate for the danger of infection. In women with contracted pelves the occurrence of multiple pregnancy is in some respects an actual advantage. It occasionally happens that such a woman, after losing a series of normal single children through dystocia due to contracted pelvis, has given birth to living twins (I have myself had such a case), and even in cases in which the latter were both in shoulder presentation (Strassmann). For this reason it is highly important, before inducing premature delivery for contracted pelvis, to obtain the assurance of the non-existence of twin pregnancy. Symphyseotomy must never be performed unless assurance of a single pregnancy exists. If the diagnosis of twins has been made at any period, the woman should never be informed of the fact; she should be told the truth only after the first birth. The leading indications for intervention in twin labors vary with the two children. The presence of inertia, so common in these births, renders it necessary at times to hasten the delivery of the first twin by artificial measures. With its fellow it may be necessary to hasten birth by reason of hemorrhage or failure of the fetal heart. The necessity for narcosis which often arises during extraction of the first child adds to the likelihood of such indications. As the great majority of twin births terminate spontaneously, non-intervention should be the rule, especially in vertex presentations. If the inertia is unduly prolonged, the membranes should be ruptured at a period somewhat earlier than in single births. The first step after the first child has been delivered and the cord ligated is to make a vaginal and abdominal examination. If the second fetus be found in any but a shoulder presentation, there should be no immediate intervention save for causes to be described later, since in most cases delivery is easy owing to the dilatation of the birth canal by the first child, and because, owing to the danger of post-partum hemorrhage, the rapid emptying of the uterus is inadvisable. The uterus should be followed down by the hand during the stage of expulsion, and every precaution should be taken against the occurrence of hemorrhage. If the second fetus is found in a shoulder presentation, cephalic or podalic version should be performed and extraction effected immediately unless the version can be accomplished by the external or combined methods alone. Post-partum hemorrhage after the first labor is a complication to be reckoned with. It must be remembered that tears of the cervix, vagina, and perineum are very rare in twin labors, and that the appearance of hemorrhage after the first birth points almost certainly to a placental origin. If the placenta is single, the escaping blood is a menace to the child coming after;

if double, the second child is not compromised. In any case of uncertain diagnosis the second fetus must be given the benefit of the doubt and delivered at once. Failure of the fetal heart is an indication for intervention. In the case of hemorrhage or other source of danger to the mother or the second infant, the latter should be rapidly delivered by forceps or complete version. If after an hour or thereabouts from the birth of the first child the uterus does not contract, the condition of atony usually demands intervention. Some authorities see no harm in waiting as long as three hours if the condition of the mother and fetus is favorable. Many cases are on record in which the second fetus has remained *in utero* for several weeks and been delivered in a vigorous condition. Hence, if the first child is premature and is followed by its placenta, it may be wise to leave the second child *in utero*, that its chance of ultimate survival may be improved. When it is decided to interfere, the membranes should be ruptured and massage of the fundus begun. As a rule, all the secundines are expelled at once after the birth of the second child. Owing to its large size, it is often difficult to bring away the placenta by Credé's method. There is after twin labors a marked tendency to atony of the uterus which demands an extra large dose of ergot and prolongation of the usual interval of medical supervision. The likelihood of hemorrhage is naturally increased if the twins are expelled in quick succession, as this amounts to precipitate labor. In rare cases both placentæ are expelled before the birth of the second child, which must then be delivered at once to avoid suffocation. In the case of unioval twins (with but one placenta) a twisting and entanglement of the cords sufficient to retard delivery may occur. In this case it is well to cut the cord between two ligatures and deliver at once; or the division of both cords may be required. In rare cases the first fetus may be transverse while the second is astride of it (Fig. 758). This possibility should be remembered, since in such a case traction on the legs of the second would be disastrous.

Management of Triple Labor.—Labor here is generally easy because of the small size of the fetuses. As in twin births, dilatation occurs slowly by reason of the inertia of the distended uterus. When expulsion begins, however, the labor may be precipitate, each fetus being small and the last two requiring no delay for dilatation. Each bag of waters presents and ruptures in turn, but the placentæ and cords show much variation. Each placenta may follow its fetus as in single births; the first two placentæ may come away after the second child, or all three may follow the third fetus. The interval between the labors varies greatly. In a precipitate delivery there is no interval and the children may all be expelled in fifteen or twenty minutes. In other cases there may be a short interval between the births of the first and second fetuses and a much longer one between the second and third, or this may be reversed. Apparently the complete uterine repose which occurs between labors in a twin pregnancy is less common in triple births, but may extend over hours and even days. The principal presentation is the cephalic—about 60 per cent. The tendency to abnormal presentations is usually seen in the last child. The prognosis for the mother is less favorable than in single births. Notwithstanding what has been said of precipitate labors and short intervals, there are many protracted confinements which with the frequency of abnormal presentations contribute to the morbidity. Puerperal complications are frequent. The fetal mortality is very heavy, no less than 31 per cent. being still-born.

XVI. MULTIPLE OR COMPOUND PRESENTATION.

Owing to the small size of the fetus in multiple labors the element of dystocia, whether maternal or fetal, is essentially out of the question under ordinary conditions. Indeed, multiple pregnancy is an actual advantage to a woman with contracted pelvis. The situation is very different when the two children tend to engage in the pelvis at the same time, and especially when, by reason of the unusually small size of the heads, they succeed in so doing. Two types of complication thus arise, termed respectively (1) multiple presentation and (2) interlocking of fetal heads. These will be described separately.

1. **Multiple Presentation.**—In multiple presentation we find parts from both fetuses at the pelvic inlet, and while engagement of both presenting parts may be possible, labor may be retarded by the fact that neither part is able to pass the brim. The presenting parts may be two heads, head and breech, head and limbs, or all the lower extremities (Figs. 695, 696, 697, 762, 763, 764). *Treatment:* In the case of two heads or a head and breech, the hand introduced into the vagina should endeavor to push one of the presenting parts, preferably that which is higher up, upward and out of the way. While this manipulation might suffice, some authors advocate engagement of the lower head with forceps to prevent a return of the complication. If a head and limb present together, the latter may be pushed up and the head engaged with the forceps. If the lower extremities descend into the pelvis, those which belong to the second fetus should be pushed up while the first fetus should be extracted by its feet. A complication of somewhat similar nature occurs when both bags of waters project into the dilating cervix and delay labor. It is necessary to wait until the os is fully opened, after which the most advanced bag should be punctured. The question of multiple presentation has a medico-legal aspect, for the subject of the right of priority of birth sometimes arises. One fetus could present first by an extremity, for example, while the other might be born before it.

2. **Interlocking of Fetal Heads.**—Interlocking of the fetal heads occurs in several ways. (1) When the heads are unusually small, a double cephalic presentation may result in the engagement of both, the second entering the pelvic cavity closely after the first, and becoming impacted against the neck or thorax of the first child (Fig. 699). *Treatment:* In the first form of interlocking the management usually advised is to deliver the first fetus with the forceps and then to extract the second. If the locking cannot be overcome, it may be necessary to perforate and dismember the first fetus, as otherwise both may be lost. The second child has the advantage over the first in that its cord is in less danger of compression. Some authorities appear to regard the prospect of unlocking these heads as practically hopeless, and proceed at once to perform craniotomy on the first fetus. (2) If the first twin has presented by the breech and has entered the pelvis with the exception of the head, the second head may slip past it into the excavation. If the fetuses are face to face, which is the usual relation, the two chins may become locked together; if back to back, the occiputs; and if the back of one is to the face of the other, the locking occurs between the chin and occiput (Fig. 698). *Treatment:* The first step is an attempt to push the head of the second fetus up out of the pelvis. Failing in this, expectancy may be tried; but if there is no advance, the forceps should be applied. If delivery is still impossible, the head of the fetus which dies first (usually the first one) should be perforated and extracted in an attempt to save its fellow. (3) A second fetus in shoulder presentation may engage during the birth of the

first fetus, so that the latter is arrested before some part of the trunk has entered the pelvis. *Treatment:* The engaged portion of the second fetus must be replaced and traction made upon the other by the forceps or hands, according to the presenting part. If the first fetus is dead, it should be decapitated and an attempt made to extract the other by version.

XVII. EXCESSIVELY LONG CORD.

The cord is frequently increased in length; instances being recorded in which it was from six to nine feet long. A long cord may become entangled in knots or it may become coiled about the fetus till so little is left that the symptoms of short funis are produced, causing delay in delivery. (See page 559.) It predisposes to prolapse of the funis. When the cord is coiled several times about the fetus, compression is liable to cause serious or fatal asphyxia.

XVIII. SHORT CORD.

Definition.—Measurements of many thousands of umbilical cords show that the great majority have a length of from 17 to 24 inches (43.18 to 60.96 cm.). An absolutely short cord is one which is too short to permit of delivery of the fetus before the separation of the placenta (Fig. 280). At the moment of expulsion the distance between the fundus uteri and the vulva is about 8 inches (20.32 cm.). The cord must therefore be at least of that length to permit of the birth of a child. But the distance between the umbilicus and anus of the latter must be added if expulsion is to occur easily, so that the minimum normal length of the cord should be one foot (30.48 cm.) for head presentations, and by a like calculation 15 inches (38.1 cm.) in breech cases. An absolutely short cord must therefore be less than 15 inches (38.1 cm.). This calculation was made by Tarnier and Leroy in 1893, who state that the extensibility of the cord makes the above figures slightly too small (about 10 per cent.). The same effect of shortening may be produced in connection with coiling of the cord about the neck or limbs. This is termed the accidentally short cord, and is elsewhere considered. (Page 237.)

Etiology.—The naturally short cord is purely an anomaly of development. It has been noted in successive labors in the same woman. In a portion of the cases reported the amniotic fluid has been scanty.

Symptoms and Diagnosis.—There is no method by which a short cord reveals itself during pregnancy, for even if the position of the child were affected, as has been claimed, no distinction could be made between natural and artificial shortening. During labor, symptoms, while pronounced, are equivocal. With everything favorable for timely expulsion of the child, labor does not advance properly. The traction upon the cord during each pain is followed by a recoil of the presenting part, which is due to the elasticity of the funis. In individual cases the condition has been recognized by a combination of rational symptoms, such as tugging and unusual distress at the placental site. It doubtless happens that the conditions become manifest only when the placenta gives way with hemorrhage, or when the uterus becomes inverted. It would seem, at first sight, that after labor was well advanced the introduction of the hand might lead to a recognition of the condition, but practically nothing can be learned in this way. Little distinction is made in practice between a naturally and an artificially short cord. Brickner gives the *symptomatology of short cord* as follows*: (1) Recession of the head

* "Am. Journ. Med. Sciences," Nov., 1899.

between pains; (2) arterial hemorrhage during and between pains; (3) urination between pains during expulsive stage; (4) pain over the placental site, worse during the expulsive period; (5) desire to sit up and lean forward; (6) uterine inertia.

Prognosis.—The mother is endangered by the possibility of hemorrhage and inversion of the uterus. A considerable proportion of infants are still-born.

Treatment.—If there are reasons for suspecting the presence of a short cord, the membranes should be ruptured, manual expression begun, and the forceps applied. According to Budin, attempts to uncoil the cord or to perform podalic version are strictly contraindicated. If brevity of the cord is not suggested till the head is arrested in the excavation, there are no resources beyond the same combination of manual expression and forceps. The cord may rupture under traction, and in that case labor must be terminated rapidly and the funicular hemorrhage checked. After extraction of the head a coiling of the cord about the neck may be discovered. It is then better to cut and ligate the cord than to try to loosen the coils. The artificially short cord must not be confounded with the cord simply coiled about the neck or limbs, producing no dystocia. Some of these coils may be detached incidentally during internal version.

XIX. RUPTURE OF THE UMBILICAL CORD.

Rupture of the umbilical cord is an accident of rare occurrence This accident may arise from shortness of the cord, which may be congenital, or from the cord becoming wound about the fetus. It may also be due to abnormal insertion of the cord, or to precipitate labor. The child usually dies from shock or asphyxiation, or rarely from hemorrhage; since the ruptured vessels are protected by the retraction of their tissues and by the covering of Wharton's jelly. When this complication takes place before the child's birth, either immediate version or the use of the forceps is indicated.

XX. DECAPITATION OF THE FETUS.

This complication is also very rare, but sometimes occurs when too much force has been applied to the after-coming head, either in a normal breech presentation or after version. The forceps or the craniotractor must be used to extract the fetal head, external pressure at the same time being employed to hold the latter in place. Danger of maternal laceration from bony spicules should be carefully avoided. (See Operations, Part X.)

XXI. AVULSION OF THE FETAL EXTREMITIES.

This can take place only when the fetus is premature or partially macerated. After its occurrence the rest of the body should at once be extracted. It will be well to follow extraction by an antiseptic douche.

XXII. FETAL MALFORMATIONS, DEFORMITIES, AND ANOMALIES PRODUCING DYSTOCIA.

Double Monsters.—The malformations which give rise to dystocia are limited practically to the double monsters. Single fetuses with malformations do not, as a rule, produce obstructed labors. Double monsters as causes of

dystocia are best divided, as proposed by Veit, into: (1) Those with slight separation; (2) those with moderate, and (3) monsters having a great degree of separation.

We may state that the greater the separation the greater the likelihood of dystocia (Figs. 385 to 435). The general principle of treatment which I follow in these cases is: (1) Determine the character of the obstruction by passing the hand into the uterus. (2) If an extraction with the aid of decapitation and possibly eventration seems feasible deliver in this way. (3) If a prolonged

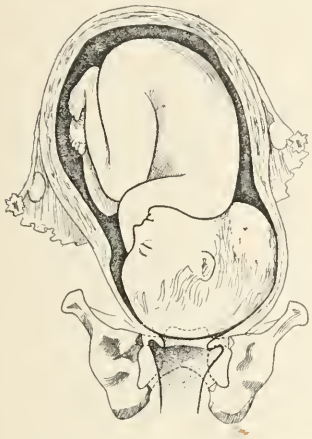

Fig. 765.

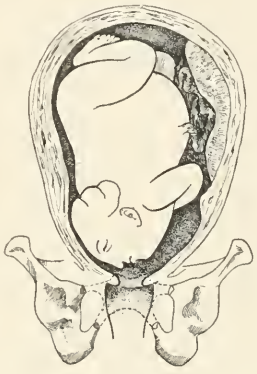

Fig. 766.

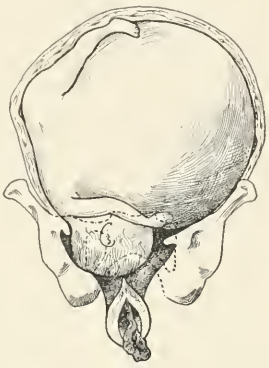

Fig. 767.

Fig. 768.

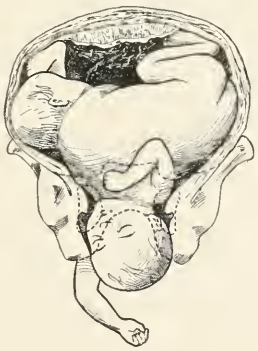

Fig. 769.

Figs. 765 to 769.—Fetal Deformities Producing Dystocia. Fig. 765, Congenital hydrocephalus. Fig. 766, Anencephalus. Fig. 767, Distention of bladder and ureters. Fig. 768, Dicephalus dibrachius. Fig. 769, Thoracopagus.

mutilating and difficult extraction is required, it is better to at once perform Cæsarean section. (4) Should the Cæsarean section be undertaken after prolonged attempts at delivery, and sepsis is suspected, either an incomplete or complete hysterectomy should follow the Cæsarean section.

Oversize of the Fetus.—There is no standard of oversize, though infants weighing over 13 pounds (about 6000 gm.) at birth are very rarely encountered. A few cases of giant fetuses weighing 20 pounds (9000 gm.) and upward have been recorded. Excess of weight, however, does not necessarily involve a dystocic labor, for the head of such a child may have a good capacity for

moulding. A representative case of an overdeveloped fetus causing dystocia is one described by A. Martin.* The child weighed over 16 pounds (7500 gm.), and could not be delivered until craniotomy had been performed. Dystocia from overdeveloped children is common. *Etiology:* Overdevelopment has but two known causes: (1) Heredity; the children of giants, especially the male children of a giant father, having a tendency to overdevelopment even *in utero.* (2) Prolongation of pregnancy. Post-mature fetuses naturally continue to increase in size until the deferred labor sets in. *Symptoms and Diagnosis:* A very large child *in utero* may simulate a twin pregnancy or other conditions of distention. Careful palpation and cephalometry (page 180) will show that there is but a single large child. Gestation with a very large fetus is accompanied by the same phenomena as is multiple pregnancy. The distention is partly accounted for in the first case by the increased volume of the placenta and amniotic fluid. Labor with overlarge fetus is naturally slow and numerous accidents may arise. During dilatation the cervix may give way with a prolonged tear involving the body of the uterus. There is a similar danger of rupture of the lower part of the birth tract, especially the perineum. Diagnosis must be made between a normal large head and hydrocephalus, short funis, and other causes of dystocia. *Treatment:* If labor cannot end spontaneously without danger to mother and child, the indication is clear to apply the forceps. Version is not to be attempted. If the child succumbs during expulsion, embryotomy should be performed.

Oversize of the Head.—A perfectly normal fetus may have an abnormally large head, associated often with a tendency to premature ossification, with resulting diminution in the size of the fontanelles. These heads resist moulding, and this fact, in addition to their size, renders them apt to produce dystocia. *Treatment:* The indications are the same as in the preceding class; viz., expectancy at first followed later by the forceps if necessary, or perforation in the case of death of the child.

Premature Ossification of Fetal Skull.—The symptoms, results, and treatment are the same as the preceding.

Congenital Hydrocephalus.—*Diagnosis:* Abdominal palpation may discover a large, hard, round tumor situated above the pubes, while the cardiac sounds will proceed from a point above the umbilicus. Naturally the abdomen is greatly distended. Failing to recognize the usual evidences of a head presentation, the practitioner may believe that a breech presentation exists. Examination with the entire hand is necessary for diagnosis. In breech presentations the presence of a large mass in the uterus during expulsion of the trunk might lead to belief in the presence of a second fetus, uterine fibroid, etc. The presence of spina bifida in breech cases has sometimes led to a suspicion of hydrocephalus. *Prognosis:* The outlook is grave. Very few labors terminate spontaneously. In cases in which an early diagnosis is not made the mortality is high. When the complication is foreseen, the outlook for the mother is good. For the mother in undetected cases the outlook is bad, although it has been recently improved by superior antisepsis. The mortality to the mother averages about 25 per cent. (Poulet and Spiegelberg). Rupture of the uterus is not uncommon, either near the cervix or at the fundus. Vesico-vaginal fistula may result from the pressure of the fetal head. If the nature of the complication is unsuspected, matters may be made worse by attempts at version or forceps delivery. *Treatment:* The prophylaxis of hydrocephalus hardly exists, despite certain efforts in this direction. If

* Cited by Tarnier and Budin, edition 1900, Paris.

the condition is recognized during the latter months of pregnancy, the fetus may be placed in a pelvic presentation, as there is less danger then of rupture of the uterus. When labor is much delayed by this complication, puncture of the head and withdrawal of the accumulated fluid are demanded. The cranial bones then collapse. If the aspirator is used, it will withdraw the fluid effectually, and give the child a chance of life. Even a short period of extra-uterine existence may sometimes be of great medico-legal importance. After perforation, turning has been advised, but this is usually superfluous, for the pains are generally sufficient to complete the birth. If there is difficulty in the descent of the head, application of the cephalotribe is in order. This will crush the head, so that it will be readily extracted. The forceps should not be used, for the blades are too short, and the cephalic curve is not large enough. The head, too, is so distended that its form changes with pressure to such a degree that the forceps cannot secure a firm grasp. It is only when the head is closely and deeply wedged in the pelvis, and its capsule is unyielding, that any success with the forceps may be hoped for. In breech cases the skull may be perforated from beneath. The French claim that the simplest manner of withdrawing the fluid is by puncturing the spine. This procedure, adopted by Tarnier in 1868, has been employed by all of his pupils. I always perforate through the floor and roof of the mouth. Cases of shoulder presentation should be treated by preliminary podalic version and afterward as in the management of breech cases. If version is contraindicated, decapitation should be practised.

Encephalocele; Hydrencephalocele (Figs. 329, 330).—This condition is rarely a cause of dystocia. The tumor which projects from the skull consists only of fluid in a membranous sac. If large enough to obstruct labor, it could readily be tapped. **Epignathi** (Fig. 430): These parasitic tumors, growing as they do from the mouth, are able, if they are large, to cause more or less dystocia. They are freely movable on the fetus and extraction can usually be effected by version. If this fails, the epignathus must be reduced in size. **Anencephalus** (Fig. 367): In this monstrosity dystocia arises from the fact that the rudimentary skull is insufficient to pave the way for the shoulders. The condition is therefore one of shoulder dystocia, for which see page 538. **Cystic Hygroma:** These cystic formations grow from the neck or the front of the chest, and may equal the fetal head in size. They are retention cysts which arise after occlusion of the lymphatics. **Congenital Cystic Goitre:** This may be classed with the foregoing in relation to dystocia. Winckel gives considerable attention to these cysts of the neck, as do also Tarnier and Budin. The cysts are not diagnosticated until labor has begun, and then are made out only with several fingers in the vagina, and sometimes not until after delivery. If moderate traction will not bring away the child, the tumor should be punctured with a curved trocar. The greatest care should be taken, since these cysts do not jeopardize the child.

Unusual Width of the Shoulders and Chest.—The shoulders and thorax of a very large child do not appear to cause dystocia. Unusual development of these parts in an ordinary child, as well as the absolute and relative width of the shoulders in pseudo-encephali and anencephali, constitutes the state which produces dystocia. Similar in dystocic effect is congenital hydrothorax. Labor in such cases might be arrested with the shoulders in the inlet, and the efforts of the uterus to expel the child might asphyxiate it as a result of compression of the chest. *Diagnosis:* These conditions cannot be recognized till after the birth of the head or the breech, when, with the entire hand in the vagina, the diagnosis may be made. *Treatment:* This should not be

confounded with the management of deficient rotation of the shoulders. To overcome the impaction present in actual dystocia it will probably be necessary to perform cleidotomy. (See Operation, Part X.)

Ascites.—(See Trunk Dystocia.) (Fig. 767.)

Tumors which Originate in the Urinary Apparatus.—These comprise accumulations of fluid in the bladder or kidneys due to imperforate urethra or some other malformation, and also the condition known as congenital cystic degeneration of the kidney. Both distended bladder and hydronephrosis may attain an enormous size in comparison with the fetus (Fig. 767). While the average quantity of urine which thus accumulates is not over a pint, there are cases upon record in which the retention amounted to seven quarts. The kidneys in cystic degeneration form a large, solid tumor which is made up of innumerable retention cysts developed from the urinary canaliculi. These cysts are filled with urine, and when the process is extensive a large abdominal tumor results. It is supposed that the retention is due originally to a sclerotic process in the renal papillæ. An analogous affection of the liver sometimes coexists.

Dystocia Due to Affections of the Fetal Trunk.—*Symptoms:* During labor in cephalic presentations after the head is born, the process of delivery is arrested. If an inexperienced practitioner attempts to extract the child forcibly, he will be likely to disrupt it. If the case is a breech, the conditions are analogous. A fetus with retention of urine almost always presents by the head. Naturally there is a scantiness of the amniotic fluid. *Diagnosis:* If there is obstruction due to something above the shoulders, the entire hand should be inserted into the birth tract, when the nature of the obstacle will become apparent. An attempt should be made to determine whether the tumor is solid or fluid. An analogous course should be pursued in breech cases. *Prognosis:* The outlook is naturally grave for the fetus. For the mother, all depends upon the management of the case. If the cause of dystocia is not recognized and removed, she will be exposed to extensive rupture of the genital tract by the futile attempt at delivery. If the correct diagnosis is made, the mother's chances are vastly improved. *Treatment:* In head presentations with the head arrested in the excavation, the forceps should be applied to deliver it. Any coils of cord about the fetal neck should be unwound. Traction should be resumed gently until no further advance is possible, after which the hand in the vagina will complete the diagnosis as to the nature of the tumor. If the latter contains fluid and the infant is dead, the abdomen should be opened by a perforator. Labor may then be readily completed. If the child is living, puncture should be made at the umbilicus with a fine trocar. If the tumor is solid, the child must be eviscerated whether dead or alive. In breech cases an analogous course must be pursued. It must be remembered that the placenta is very large in some cases of ascites; if this is forgotten, the uterine tumor might suggest a second fetus.

Sacro-coccygeal Tumors.—(Figs. 432 and 770.) They are seldom recognized during pregnancy. Hydramnios is present in the vast majority of cases. *Symptoms:* Labor is almost always premature. The head usually presents. Delivery occurs spontaneously in the vast majority of cases. This implies that the majority of tumors are too small to affect labor. More or less dystocia must occur with growths the size of the fetal head. The degree of dystocia is not in proportion to the size of the tumor, for the latter may be partially cystic, and hence easily reducible in size. In head presentations with a large solid tumor the latter will probably be expelled spontaneously after a period of moulding. In pelvic presentations a high degree

of dystocia may result, the trunk and tumor seeking to engage at the same time. If the feet are down, efforts at traction might disrupt the fetus. *Diagnosis:* This can be made only with the entire hand in the vagina, chloroform having been given. A tumor of this sort might well be confounded with a number of conditions, fetal or maternal. Budin states that the commonest error is the assumption of the presence of a double monster united at the breech. *Prognosis:* In dystocia the maternal prognosis depends, as in all similar conditions, upon the time at which the diagnosis is made. The outlook for the child is very poor, there being but a small proportion of survivors. *Treatment:* The dystocia is less than in the case of abdominal tumors. In head presentations traction should be made with forceps until it becomes evident that delivery is impossible. Puncture should be practised in several places in the hope that the tumor is partly fluid. If this fail, the child must be eventrated, after which the legs may be extracted and the tumor treated by morcellation, while in a breech case the tumor must be made to present first with the same intent.

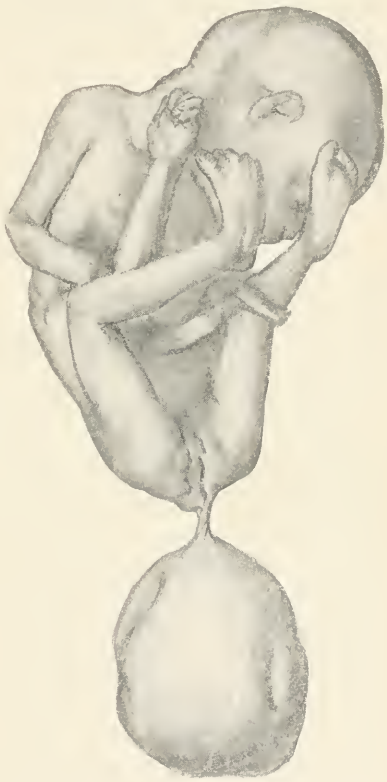

FIG. 770.—SACRO-COCCYGEAL TUMOR IN A FEMALE FETUS BORN AT THE SIXTH MONTH.—(*Author's collection.*)

XXIII. FETAL RIGOR MORTIS.

Although death of the fetus is of such common occurrence, rigor mortis has been noted so rarely that the possibility of such a phenomenon has been denied. Ballantyne, who has seen one case, gives references to about twenty-five others in literature, several of the latter having been described in connection with Cæsarean section. Cadaveric rigidity in the fetus is believed to be feeble and transitory, and to escape observation unless death occurs just before labor begins. In some cases, however, the condition is well marked, and may last for hours, proving a source of fetal dystocia. Wolff* analyzed 34 recorded cases of this phenomenon. The claim which has often been made that eclampsia plays a prominent part in its genesis is not borne out by statistics, for maternal convulsions occurred in but 8 of these 34 cases. This coincidence is evidently due to the fact that the fetus often perishes during an eclamptic delivery. For similar reasons we find the coincidence of protracted and obstructed labor, prolapsed cord, placenta prævia, premature detached placenta, etc., on one hand, and antenatal rigor mortis on the other.

Of the 34 cases detailed by Wolff, no less than 30 were associated with the conditions just enumerated.

These, however, were not sufficient in themselves to determine rigor mortis in the fetus. In a large proportion of cases, the latter may be brought in re-

* "Arch. f. Gynäkol.," LXVIII, 1903.

lation with death of the mother during labor, and it is not uncommon for the rigid state of the fetus to be recognized in connection with Cæsarean section on the dead or dying.

On June 12, 1904, a primipara, age 30, already fourteen hours in labor was admitted into my service at the Bellevue Emergency Hospital. Cæsarean section was required, and performed by my assistant, Dr. Moore. Two hours before the operation the fetal heart sounds were heard by several observers. A dead nine pound child was extracted with *rigor mortis* present to a marked degree. The extremities were flexed upon the body and were so rigid as to make it practically impossible to extend them. The fetal body and neck were also in complete *rigor mortis*. This case was of rapid development, as the fetal heart sounds had been heard up to two hours of operation. The patient died suddenly eighteen hours post-partum. No autopsy could be obtained.

DUE TO ABNORMAL CONDITIONS IN THE MOTHER: MATERNAL DYSTOCIA.

Physical Phenomena of Maternal Dystocia.—Much confusion exists in regard to the results of difficult labor upon the maternal organism, and the terms "primary inertia," "uterine exhaustion," "secondary inertia," "tetanic state of the uterus," "delayed labor," "obstructed labor," are applied somewhat indiscriminately to designate various phases of such conditions. An attempt is made to submit these conditions to a brief analysis.

Primary Inertia.—Here the sluggish action of the uterus is not due to exhaustion. The causes lie in the uterine muscle itself, which is unable to contract forcibly. We see this in the very young and in the elderly; in invalids and in distention of the uterus by hydramnios, multiple pregnancy, etc. The pains are weak and occur at long intervals. There is no constitutional reaction beyond fatigue. The subject of inertia is considered in detail under Protracted Labor.

Secondary Inertia, Exhaustion of the Uterus.—This appears to be the result of inertia of the uterus plus slight obstruction; although the latter is not always in evidence. The pains, feeble at the start, ultimately cease. The uterus seeks rest. This temporary suspension of the pains has been termed *secondary inertia* in contradistinction to obstructed labor with original absence of inertia. Exhaustion of the uterus betrays itself by flabbiness, which enables the obstetrician to recognize the outlines of the child. There is no tenderness on pressure. Aside from fatigue, constitutional reaction is absent. After rest, food, and sleep the uterine contractions reappear.

Tetanic State of the Uterus.—This anomalous action of the uterine muscle develops when an obstruction is present. The original pains become vigorous when the obstruction is first felt, but if the impediment cannot be overcome, the intervals between the pains become shorter and shorter until the tetanoid state develops. The fetus is closely embraced by the uterus and the constant pressure tends to interfere with the placental circulation. The constitutional reaction is marked, as the tetanic contraction rapidly exhausts the mother. Her pulse and respiration increase and her face shows anxiety. The uterus is hard and perhaps tender. It holds the fetus firmly, so that the presenting part cannot be pushed up. If the head has reached the true pelvis, it shows a marked caput succedaneum, while the lower part of the birth tract is swollen. In this condition immediate delivery is the indication.

Prolonged Labor.—Primary inertia, exhaustion, and obstruction all tend to lengthen the duration of labor. What is meant by prolonged labor in the nar-

rower sense of the term is the result of a moderate disproportion between the force and the resistance. Let us suppose that the pains are strong and that the resistance does not amount to obstruction. Tetanus uteri does not develop. The woman is simply in the position of one who makes great and long-continued muscular exertion, and the results are those which follow such efforts. The pulse rises to 100 or 120 and there is rise of temperature. The patient becomes anxious, distressed, and restless; vomiting of reflex origin may occur; the tongue is coated, the vaginal and cervical secretions are arrested, and the parts are hot and dry. Such a clinical picture may be seen in breech presentations.

Obstructed Labor.—Tetanic contractions indicate that there is an obstruction to labor. There is only a difference in degree between a protracted labor as described and an obstructed labor. The term should be restricted to cases in which delivery by natural passages is impossible. At the outset the symptoms are those of protracted labor. Finally exhaustion of the mother begins; the pulse becomes weak and thready; jactitation indicates the high degree of nervous prostration; the tongue becomes black and dry, and the patient passes into a typhoid or adynamic state as a result of the profound exhaustion.

MATERNAL DYSTOCIA FROM THE FORCES.

I. PRECIPITATE LABOR.

Definition.—Labor terminating so rapidly as to interfere with the physiological processes of the several stages. Its occurrence is comparatively infrequent. A narrower definition is labor of such rapid and unforeseen character that the parturient is confined in an entirely unusual position, as standing, squatting, kneeling, or sitting.

Etiology.—Excessive expulsive powers, either voluntary or involuntary, and deficiency in the resistance in the parturient canal or bony pelvis are the main etiological features. The physical condition of the patient seems to have little or nothing to do with the excessive contraction. Deficiency in the resistance may result from a number of causes. For example, there may be an undersized child at full term or as the result of premature labor. The parturient canal itself may be oversized and roomy and relaxed as the result of the general physical condition or nervous influences independent of an increase in the size of the pelvis. The justo-major or giant pelvis and the split or inverted pelvis are the two conditions in the hard parts predisposing to precipitate labor. It may be that in a previous confinement there have been lacerations of the cervix or perineum, or both, allowing the fetus to be precipitated through an orifice, instead of being forced along, as is normally the case.

Symptoms.—The symptoms are those of a rapidly terminating labor. The pains appear suddenly and increase very rapidly in intensity. They are usually of a bearing-down character from the beginning. Labor may be over in a few minutes when the pelvis is large or the fetus small, even without any excruciating pains. However, the converse may prove true. The child may even be born while the mother is asleep.

Diagnosis.—One or two contractions sometimes expel the fetus. In other cases palpation shows a rapidly advancing presenting part, almost continuous tetanic action of the uterus, and forcible contraction of the abdominal walls. The latter may be absent. In cases in which there are only one or two severe con-

tractions the patient is probably of a sluggish, apathetic temperament and does not really feel much pain. In other cases which are not so rapid the suffering may be intense. If the child dies from rupture of the cord as a result of precipitate labor, the mother may be subjected to judicial inquiry by reason of the fact that infanticide is sometimes committed through neglect to ligate the cord. Similarly, a fall of the child in connection with precipitate labor may lead to injuries of the cranium, limbs, viscera, etc., and hence the suspicion of attempt at infanticide may be aroused. In cases of this sort in which the mother is accused but denies all intent of injuring the child, corroboration of her word may be supplied by study of the pelvis and soft parts and of the fetus. If the pelvis is over-large and there are old lacerations which have diminished the resistance, etc., or if the child is unusually small, we have conditions which favor precipitate labor. If we find the uterus inverted, extensive fresh lacerations of the soft parts, with a history of post-partum hemorrhage, etc., we have conditions which may have been caused by precipitate labor. In regard to the child dead of hemorrhage from the cord, it will be necessary to exclude the existence of patent umbilical arteries, anomalies of the cord and vessels, and hemophilia. Much may be learned from cross-examination of the mother.

Prognosis.—The dangers to the mother are hemorrhage from premature detachment of the placenta, lacerations of the parturient tract, post-partum hemorrhage, inversion of the uterus, serious or fatal syncope from sudden diminution of intra-abdominal pressure, and uterine inertia. The dangers to the fetus are ante-partum asphyxia from premature detachment or compression of the placenta or from rupture of the cord, and injury from a fall to the floor, to the street, or into the basin of a water-closet. I had a case in practice of a child being born by precipitate labor into the bowl of a water-closet. I was asked once to see a depression in a parietal bone in a newly born infant, the result of precipitate labor on the fire-escape of a tenement-house. The mother at the time was leaning over the railing and drawing the clothes-line toward her. Both these children survived. I have also witnessed a precipitate labor in a patient ascending a staircase in a maternity hospital, the child's fall in this case being broken by being suspended by the cord. No complications resulted to the mothers in these three cases.

Treatment.—When precipitate labor has once occurred, it is likely to take place again, and in such a case, preventive treatment is in order during pregnancy. During the last few weeks of pregnancy the patient should not go far from home and should secure fresh air by driving rather than walking. A competent nurse, who can take entire charge of labor if necessary, should during this time be in attendance. A well-fitting abdominal binder (Fig. 228) will sometimes act as a preventive measure. All mental reflex irritation must be guarded against. Repeated small doses of the bromids or of opium are of use to quiet the irritable state of the uterine muscle-fibers, as in the case of treatment of abortion. During labor the early use of chloroform or the subcutaneous use of morphin is most valuable, and all bearing-down efforts on the part of the patient must be discouraged. She should be placed in the lateral posture or, better still, in the exaggerated semi-prone (see Posture, Part X), and manual retardation of the head at the pelvic outlet practised if necessary.

II. PROTRACTED LABOR. UTERINE INERTIA.

Definition.—Labor prolonged beyond the average length (page 448) to such an extent as to be dangerous to mother or fetus; or a degree of uterine contrac-

tion insufficient to overcome the normal resistance or that produced by some abnormality. *Uterine inertia* is that condition in which the uterine contractions by reason of their weakness or irregularity are insufficient to dilate the os in the first stage, or expel the fetus in the second. The insufficiency may pertain only to a certain portion of the uterus; so that we may speak of partial and total inertia. Thus the defective action may be confined to the cervix. *Abdominal inertia* is a weak or inefficient condition of the abdominal walls which renders the patient unable to aid the uterine contractions of the second stage by her voluntary forces or bearing-down efforts. Three degrees of abdominal inertia are recognized; namely, simple inertia, exhaustion, and paresis. From the date of the beginning of uterine inertia, whether from the onset of labor or after a period of normal pains, a division is made of primary and secondary. *Primary or true uterine inertia* is that condition of weak pains in which the uterine contractions have been inefficient from the beginning of labor. It is an unusual variety of prolonged labor. Neither mother nor fetus need necessarily suffer. *Secondary inertia or uterine exhaustion* is a gradual or sudden cessation of strong uterine contraction, generally in the second stage. Contractions may subsequently recommence spontaneously.

Etiology.—The causes of *primary inertia* do not coincide with those of the secondary type. The former might arise from a great variety of conditions, as follows: (1) Defective innervation (paralysis of the nerve-centers which preside over uterine contractions); (2) defective development of the uterine muscle; (3) abnormal shape of the uterus, as in uterus bicornis; (4) abnormal position of the uterus, as in the anteversion which accompanies a pendulous abdomen, and in prolapse; (5) abnormal distention of the uterus, as in hydramnios or twins; (6) diseases and tumors of the uterine wall; (7) too intimate adhesions between the embryonal sac and the *cavum uteri*. Numerous contributory factors are also known to exist. Uterine inertia is thought to be hereditary. It is common in elderly primiparæ and in multiparæ who have gone many years without becoming pregnant. On the other hand, we see inertia frequently in the opposite condition of too frequent labors. As a rule, we find weak pains in the obese, in delicate women, in invalids, in convalescents from acute infectious diseases, and in those who are poorly nourished from any cause, especially in victims of *hyperemesis gravidarum*. Remediable factors are found in distended bladder and rectum, tympanites, and overloaded stomach; all of which have been known to impede the healthy action of the uterus. *Secondary inertia* occurs more frequently than *primary*. It is common in primiparæ whose soft parts are rigid, and, generally speaking, it is found in any condition, whether maternal or fetal in nature, which heightens the resistance to the normal passage of the child. The conditions which make up the etiology of the obstructive inertia need not be detailed in this connection. *Partial inertia* is due usually to the presence of some local lesion or tumor of the uterus. *Abdominal inertia* occurs in the presence of grave diseases, such as typhoid fever or tuberculosis; in inanition from any cause, and as a result of the inhibitory influence of pain and profound mental emotion.

It is readily apparent that primary and secondary inertia are not closely related, the latter being due to obstructive conditions which at times must exhaust the most vigorous uterus. For this reason primary inertia is sometimes spoken of as true or essential inertia while the secondary form is characterized rather as an exhaustion or paresis. Still the two forms do possess some features in common. Thus, vigorous contractions often readily overcome slight degrees of obstruction which could determine secondary inertia in a sluggish uterus.

Symptoms.—*In the First Stage.*—One of the first symptoms is the failure of the uterine contractions to cause progressive dilatation of the cervix. Soon the contractions become of short duration with longer intervals; they are accompanied by excessive suffering, giving rise to the expression "painful pains"; they become cramp-like and irregular, and finally during each painful contraction no thinning of the cervical lip or protrusion of the bag of membranes occurs. Examination of a primipara will usually reveal a firm cervical ring and no apparent obstacle to the completion of the first stage, provided only strong uterine contractions were present. In the case of a multipara the contractions present will usually be less painful, with long intervals, and a soft, flabby cervical ring will usually be found, with vaginal walls so soft and readily dilatable that it appears that only a few contractions accompanied by some abdominal efforts would suffice to expel the fetus. In either case at this period the patient may fall asleep and efficient contractions may not recur for twelve or twenty-four hours. For a long period there are, as a rule, no symptoms beyond the mere delay of labor. If the membranes are intact, this stage may persist for several days without serious effects upon mother or child. Some fatigue and loss of sleep necessarily result. If, however, the difficulty is found to be due to some condition of the cervix, such as rigid os, exhaustion will ultimately be substituted for simple inertia. (Exhaustion is considered under the head of prolonged labor in the second stage of labor.) In case of premature rupture of the membranes the symptoms become more serious, though less so than in the second stage. The liquor amnii escapes slowly and the futile efforts to open the cervix will lead to exhaustion at a much earlier period than will inertia with bag of waters intact. A tetanic contraction of the uterus may be present during the first and second stages of labor, but this is not the rule, as the contractions may be simply weak, irregular, or painful in type. Should partial or complete escape of the liquor amnii ensue, a dangerous complication results; for even should the head for a time act as a ball-valve and keep back some of the water, "*dry labor*" is always to be feared, with its tendency to retraction of the uterus, ascent of the contraction ring, dangerous thinning of the lower uterine segment, and disturbance of the utero-placental circulation. What contractions now remain tend not to cause dilatation and expulsion but a further thinning of the lower uterine segment and finally its rupture.

In the Second Stage.—In simple protraction of the second stage of labor the symptoms at the outset are not unlike those of the first stage. The uterine contractions may be weak and irregular or tetanic—usually the latter. Investigation may show that the auxiliary forces are not co-operating with the uterus. There may be no bearing-down, especially in cases in which for any reason the patient is unable to fix her diaphragm (cardiac or pulmonary disease); or when the abdominal wall is the seat of any structural or functional disease (œdema, corpulence); or when fear exerts an inhibitory effect upon labor. The extreme pain may cause the woman to cry out unceasingly, so that bearing-down is impossible. Finally, inertia may depend upon some simple local condition (an unemptied bladder or rectum), or upon some psychical cause easily remedied, as the presence of an obnoxious individual. If inertia persists during the second stage, the most important symptoms may have reference to the child, who will be almost certain to become asphyxiated. The pressure of the fetal head upon the soft parts, which will cause sloughing if continued, does not betray itself by any special train of symptoms. A general characteristic of inertia in the second stage is the dry condition of the maternal passages from the failure of the natural secretions of the cervix and vagina.

Exhaustion.—This should be separately considered, for while primary inertia

may end in exhaustion if the patient is not relieved, this abortive ending of labor is more commonly a result of obstruction to the passage of the child in the presence of contractions of the uterus originally normal. It is especially in these obstructive labors that a peculiar condition of the uterus is prone to develop which is known as "continuous action." The *continuous or tetanic action* of the uterus is brought about as follows: The abortive contractions, if regular, succeed each other with progressively diminishing intervals until they finally merge into a state of tonic contraction. Experience shows that in simple inertia the tetanic state supervenes rapidly; while in obstructive conditions with strong pains it is deferred. It is important to distinguish between this tetanic state and simple passivity of the uterus, as there is no doubt that they have been and still are confounded. Practically the tetanic uterus is an affair of the second stage of labor, though exceptions may occur. This distinction is highly important in practice, as oxytocics are absolutely contraindicated in the tetanic uterus. The symptoms of the latter are revealed by abdominal palpation, the permanent rigidity of the womb contrasting strongly with the soft, lax structures felt when the uterus is merely relaxed. Another result of the abortive labor pains is *retraction of the uterus* in obstructive cases, which is brought about as follows: The strong contractions of the uterus ultimately determine a stretching of the lower segment, which gives way under the pressure of the fetus. As the cervix stretches the body undergoes a corresponding thickening, and the retraction ring or Bandl's ring shifts its position upward. This ring sometimes becomes recognizable by external palpation, and is then regarded as indicating intervention, but not version. Retraction of the upper segment as just described is said to occur most commonly after early rupture of the membranes. Inertia, either primary or secondary, should not be confounded with non-advance of labor from undue obliquity of the uterine axis. The phenomena of exhaustion, when the latter is once established, do not differ from those of adynamia in general.

Diagnosis.—Statements of the woman to the effect that the pains are weak have little value. Diagnosis is readily made, as a rule, by palpation, which reveals the absence of a natural uterine action, and by the arrest of labor. If the presenting part advances slightly, it is only to recede again. Upon timing the pains they are found to be very short, with long intermissions. The fetus exerts active movements during the interval. The diagnostic features of tetanic uterus have been enumerated.

Prognosis.—In primary inertia the prognosis for the time being is good if the bag of waters does not rupture. Before rupture of the membranes the first stage of labor may be much prolonged, even several days, without serious result to mother or child, although this favorable ending cannot always be looked for. Nervous exhaustion which follows the suffering, anxiety, loss of sleep, insufficient food, etc., must always be guarded against, for extreme exhaustion predisposes to subsequent accidents in labor and the puerperium. If the waters break before the dilatation of the cervix, an additional cause of inertia is supplied. The chief danger to the fetus is found in the prolonged compression of the skull and placenta, which favors the development of asphyxia. The mother is threatened with the formation of a passive œdema of the parts in advance of the fetus, which in turn predisposes to necrosis and the eventual development of fistulæ, to say nothing of the added dangers of infection. It must not be forgotten that inertia has been known to terminate in precipitate delivery. This can hardly be due to sudden return of uterine vigor, but to the fact that labor has progressed more rapidly than the physician supposed. Excessive delay in the second stage is always dangerous for both fetus and mother: for the former because of asphyxia

from compression of the head and placenta; for the latter from exhaustion, pressure necrosis and fistulæ, rupture of the uterus, septic conditions, and post-partum hemorrhage from uterine atony.

Treatment in the First Stage.—In the great majority of cases of delayed labor in the first stage there is no real obstruction in the cervix. The latter will almost always dilate readily enough if the expulsive powers are sufficiently strong. The first principle of treatment is to ascertain the cause of inertia and to remove it. This may be a distended bladder or rectum, or the excessive pains of uterine contraction, especially when spasmodic in character. As the invariable indication is to accelerate the first stage of labor, any legitimate means at our disposal may prove of service, and our resources may be divided into two groups: (1) Those applied outside the parturient canal, and (2) those which we make use of within the passages. As a general principle, we should avoid recourse to the second group as far as possible.

(1) *Means for Accelerating the First Stage of Labor, which are Applied without the Passages.*—All our resources should be set in operation, even those of the simplest character. Rest, a short sleep, feeding, and stimulation are all of benefit. Exercise in the form of walking is often of value. It not only strengthens feeble contractions, but when the latter have ceased for a time,—which often happens after early rupture of the membranes,—it brings about their reappearance, doubtless through reflex excitation by the weight of the presenting part on the lower uterine segment. Other postural resources, such as the squatting position, cannot be recommended because of the danger of prolapse of the cord. The physician must not overlook the possibility that the cause of inertia may be found in a distended bladder or rectum, and must guard against such a contingency. Heat is a valuable stimulant to the sluggish uterus, and may be administered in the form of a general shower or douche bath or hot compresses applied over the sacrum and hypogastrium. In the latter form the action of the heat is reinforced by alternation with cold. A large number of oxytocic drugs have been used, some for stimulant, others for sedative action. Ergot should never be used in the first stage of labor; it should be given only after the expulsion of the placenta. Quinine is largely used at the present day, and acts probably as a purely nervous stimulant. When the stomach is irritable, I employ large doses of the bisulphate of quinine (grs. xx to xxx) in rectal suppositories. A group of sedative drugs comprises chloral, tincture of gelsemium, and the coal-tar products. These are indicated in irregular and painful contractions. Chloral is now in almost general use. Opium appears to act as a sedative in irritable conditions and as a stimulant in sluggishness. General anesthesia is contraindicated during the first stage of labor, but the inhalation of a few drops of ether or chloroform is often employed for sedative effect in irregular and painful contractions. If too much chloroform is inhaled, the action is too pronounced and the contractions may be arrested entirely. On this account, if anesthetics are employed at all, ether or the A. C. E. mixture should be preferred. In instances in which the severe pain and cramp-like action of the contractions appear to interfere with the progress of cervical dilatation, I have found that pouring a small quantity of ether into an Allis inhaler, and allowing the patient to inhale it, controls the suffering quite as well as does chloroform, and there is much less danger of producing inertia uteri. Cocaine applied directly to the cervix has been used as a local anesthetic. Manual friction of the fundus uteri, manual expression (Part X), and the like are hardly indicated in inertia of the first stage unless dilatation of the cervix is over half completed. Voluntary efforts at bearing-down are likewise of little service, save when the cervix is partly dilated, especially in multiparæ, and

when rupture of the membranes has occurred. I have abandoned the use of electricity as dangerous to the fetus in the first stage of labor. A unique resource, since it is applicable during pregnancy rather than in the midst of labor, is the continuous use of strychnine for some weeks before delivery. This is more than a mere oxytocic, for it is also a prophylactic against a flabby uterus after delivery. Its special field appears to be in debilitated women. It should be given at first in doses of $\frac{1}{60}$ grain three times daily, beginning at not less than four or more than eight weeks before the expected confinement. One week before the date of the latter the dose may be increased to $\frac{1}{30}$ or even $\frac{1}{15}$ grain. I have used the drug in this manner in many multiparæ with a history of feeble, irregular, and faulty uterine contractions, post-partum hemorrhage, or severe after-pains, and with most excellent results. Strychnine is also of use during the first stage of labor as an oxytocic, but then should be given hypodermatically. The amount given is $\frac{1}{60}$ grain every fifteen minutes until $\frac{1}{20}$ grain has been taken.

(2) *Means for Shortening the First Stage of Labor that are Used within the Passages.*—It may be that the uterus responds to the various stimuli but the woman has become exhausted from the delay, so that more radical intervention is called for. We must have made sure that there is no mechanical defect; this necessitates a careful internal exploration. The simplest internal resource is the hot vaginal douche, especially indicated in cases in which the lower uterine segment has been forced downward into the pelvis with resulting incarceration between the fetal head and the bony pelvis, causing œdema of the os. If the cervix is partially open and contractions are present which do not cause any protrusion of the bag of waters, we may suspect the presence of adhesions between the membranes and the uterine wall. This condition is remedied by the finger introduced into the cervix to the extent of two joints, and swept around within the ring of the os. In primiparæ this is difficult of execution, and it may first be necessary to push the fundus downward and backward. Care must be taken, while detaching these adhesions, to avoid rupturing the membranes, which is not so likely to happen if the finger is used rather than a catheter with stylet. If these measures are unsuccessful, intrauterine irritation in some form must be employed. Bougies introduced between the membranes and the uterine wall and allowed to remain *in situ* are attended by slow and uncertain results. A resource attended by a prompt response is the principle which underlies the bags of Barnes and Champetier de Ribes; these devices not only excite uterine contractions, but dilate the cervix as well (see Part X). As far as the simple indication of accelerating labor is concerned, it need only be said that the principle of these hydraulic dilators may usually be dispensed with, and certainly should be when possible. Some authorities regard manual dilatation of the cervix for simple inertia as nothing less than malpractice. However, very gentle dilatation intended simply to stimulate the uterus is a rational procedure and may safely be done with the fingers. (See Manual Dilatation of the Cervix, Part X.) It is especially applicable when the os is partly dilated, soft, and pushed low down into the pelvis. Incisions are as little indicated as is instrumental dilatation. If an emergency arises so that the indication is to extract the child at once, one or both of these last-mentioned procedures may be required.

In the Second Stage.—After cervical dilatation, the treatment of delayed labor usually becomes a simple matter in the absence of maternal or fetal obstruction, and resolves itself usually into the application of the forceps, when the positive indication shows itself either on the part of the fetus or on that of the mother. (Part X.) Occasionally in non-engagement of the head the

choice will be between forceps and version. (Part X.) Strychnine, friction, and compression of the fundus, encouraging and educating the patient to use her voluntary muscles in bearing-down, will in many instances bring the head into digital control in the vulva. It is at this time that supplying the patient with traction straps to pull on, thereby assisting in her bearing-down efforts will often be of assistance.

MATERNAL DYSTOCIA IN THE PARTURIENT TRACT AND ADNEXA.

III. RETENTION OF PLACENTA AND MEMBRANES.

Definition.—The placenta as a whole with its membranes is said to be retained when these structures have not been expelled one hour after the birth of the child. After apparently successful termination of the third stage of labor placental and membranous tissues may remain behind, especially when accessory formations, as secondary placentæ, are present.

Etiology.—The causes of retained placenta and membranes are as follows: (1) Adhesion of the placenta (so-called placenta accreta), which is due to a previous endometritis deciduæ. (See page 191.) This adhesion, which is seldom universal, prevents the loosening and detachment which occur naturally in the third stage of labor. (Figs. 568 to 571.) It often happens that the supposition of an adhesion of the placenta is incorrect, the delay being purely natural and due to atony, powerless contraction, etc. Such a conclusion may be arrived at when too precipitate efforts at manual expression are not rewarded. True adhesion is very rare (Fig. 771). (2) Atony of the uterus. A condition of inertia of the uterus in the third stage of labor may be the cause of retention (Fig. 772). This state may be surmised if timely efforts to expel the placenta by Credé's method are unavailing. (3) Hour-glass contraction. By this expression is meant a contraction of Bandl's ring, which incarcerates the placenta, the fundus uteri remaining in a lax condition (Figs. 773 and 774). Schauta regards this condition as one of atony of the uterus despite the contraction of the ring. (4) Contraction of the external os (Fig. 775). (5) Tetanic contractions of the entire uterus. This condition, which has been seen after the abuse of ergot, incarcerates the placenta for the time being (Fig. 776). (6) Actual incarceration of the placenta without regard to the uterine contractions is seen in certain malformations of the uterus (Figs. 456 to 465). (7) The foregoing causes refer to the entire placenta, but it is also possible, as already stated, for a portion of the placenta or membranes to be left behind through unskilful management of the after-birth period, and also despite all precautions.

Symptoms and Diagnosis.—The principal symptom is naturally the non-expulsion of the placenta. If complete adhesion is present, there will be no hemorrhage. Examination of the fundus by palpation enables us to recognize the presence of uterine atony; and the association of vigorous contractions with the non-appearance of the placenta will cause us to suspect the presence of adhesion. More or less hemorrhage may accompany either atony or partial adhesion. In hour-glass contraction the fundus feels elastic, like an inflated balloon. After apparent expulsion of the entire ovum, the persistence of fragments of the decidual structures or the presence of a placenta succenturiata might be indicated by a persistent hemorrhage, expulsion of bits of tissue, after-pains, etc.

Treatment.—*Prophylaxis:* This complication can usually be prevented by the proper management of the second and third stages of labor, but especially the latter. If the uterus is followed down with the hand on the fundus during the second stage and no traction is made upon the child to assist delivery; if the fundus is carefully held during the third stage and compression exerted

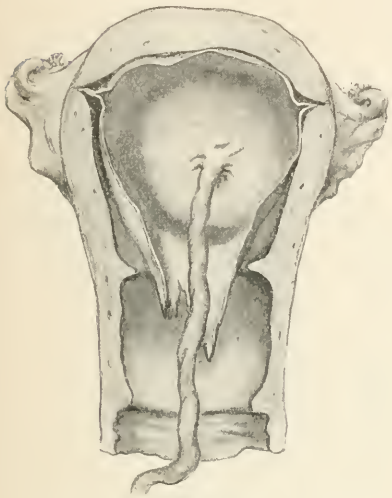

FIG. 771.—RETAINED PLACENTA FROM ADHESION TO THE UTERINE WALL.

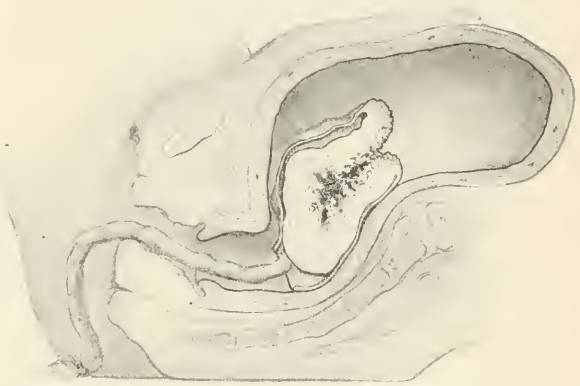

FIG. 772.—RETAINED PLACENTA FROM ATONY OF THE UTERUS.

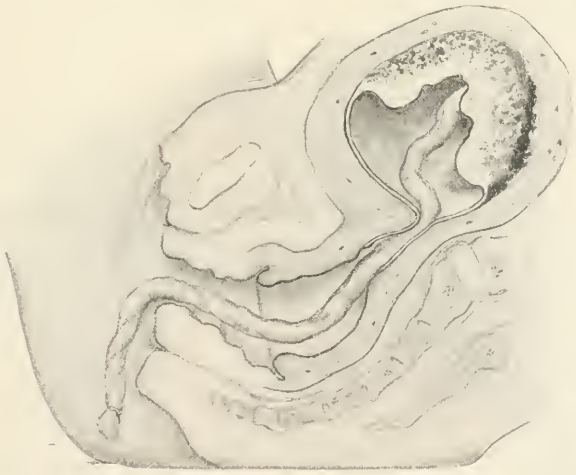

FIG. 773.—RETAINED PLACENTA FROM TIGHTENING OF THE CONTRACTION RING. ONE FORM OF "HOUR-GLASS CONTRACTION."

only after the lapse of half an hour, and then only during uterine contraction; if no traction is made upon the cord and ergot administered only after the complete emptying of the uterus, retention of the whole or a portion of the placenta will rarely occur. *Curative treatment:* This will depend upon the amount of hemorrhage present. In the presence of profuse hemorrhage with

retained placenta the indication is to empty the uterus completely by the quickest possible means; for complete uterine contraction is the surest means

FIG. 774.—RETAINED PLACENTA FROM IRREGULAR CONTRACTIONS OF ONE HORN. ONE FORM OF "HOUR-GLASS CONTRACTION."

FIG. 775.—RETAINED PLACENTA FROM TIGHTENING OF THE EXTERNAL OS. Follows the abuse of ergot. A common cause of the complication.

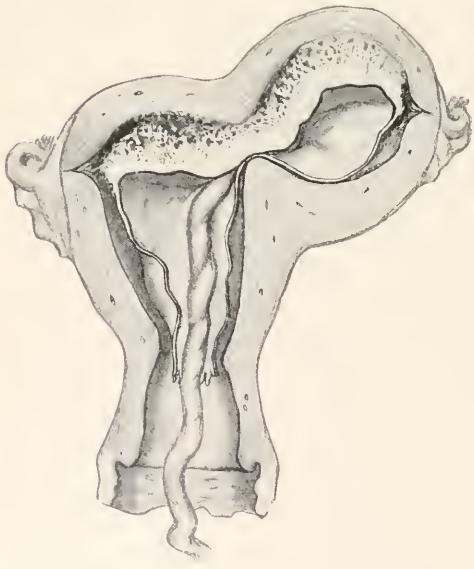

FIG. 776.—RETAINED PLACENTA FROM TETANIC CONTRACTIONS OF THE ENTIRE UTERUS.

FIG. 777.—RETENTION OF MEMBRANES.

to close the vessels and so to control the hemorrhage. Should Credé's method of placental expression fail, recourse must be had to digital or manual extraction of the placenta. (See Operations, Part X.)

IV. POST-PARTUM HEMORRHAGE.

Definition.—Post-partum hemorrhage is hemorrhage from any portion of the parturient canal after delivery of the fetus. Post-partum hemorrhage proper is only from the placental site (Fig. 778). It is *primary or immediate* when it occurs within twenty-four hours after the expulsion of the child. It is *secondary or remote* when it occurs at any time during the puerperium subsequent to the first twenty-four hours. Post-partum hemorrhage is also *internal*

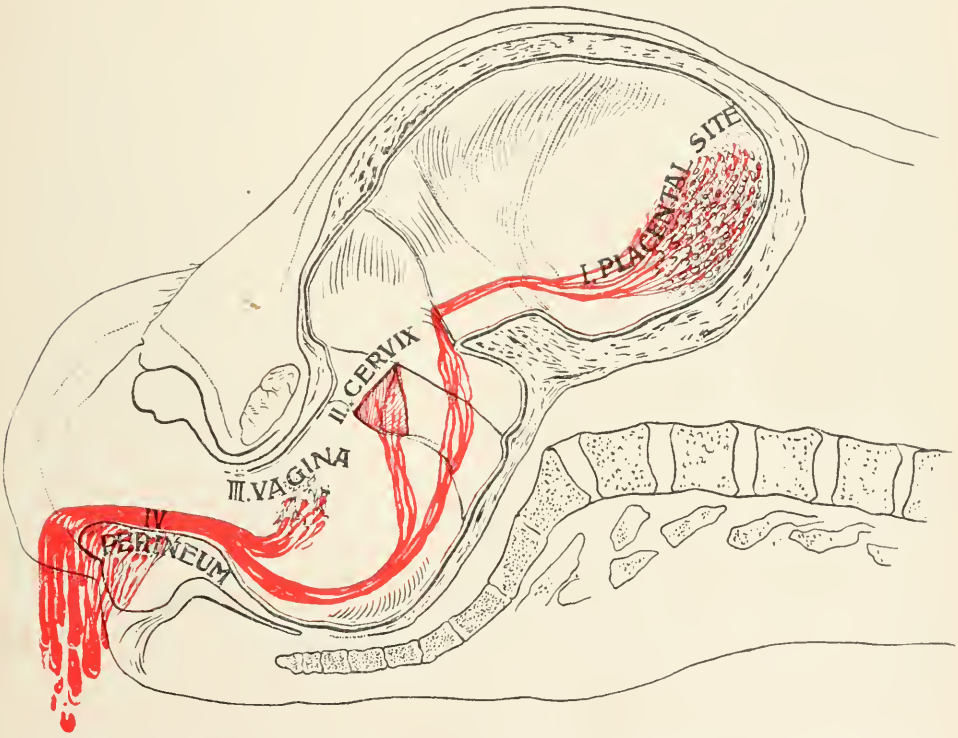

FIG. 778.—DIAGRAM SHOWING THE FOUR VARIETIES OF POST-PARTUM HEMORRHAGE.

or concealed, and *external or open*. It may occur from the cervix, vagina, or the pelvic floor (Fig. 778). The typical form is commonly known as "flooding."

Frequency.—Severe cases of hemorrhage are not common, to judge from hospital statistics; but it must be remembered that proper facilities for treatment are there always at hand. This is by no means always the case in private practice. It may be stated in general that the complication occurs in a mild form once in fifty labors; is severe, once in 1000; and fatal, once in 5000. I found in 2200 cases of confinement,—800 of which were outdoor, and the remainder hospital cases,—that post-partum hemorrhage occurred in 104 cases, or 4.72 per cent. This includes mild, severe, and fatal cases. The frequency

of the accident in hospital and dispensary practice was about the same. Of these cases, 33.65 per cent. were in primiparæ; 60.57 in multiparæ, and 5.76 per cent. had no record of parity. Of the hemorrhages, 25.96 per cent. occurred before placental delivery; 62.50 per cent. after the completion of the third stage, and in 11.53 per cent. the hemorrhage took place both before and after delivery of the placenta. Of the foregoing, mild cases occurred once in 22 labors; severe cases once in 550; and fatal cases once in 733⅓ labors. The great frequency of the complication in the foregoing cases is due undoubtedly to the common use of the forceps (see Part X) and to the mismanagement of the third stage. (Page 490.) It is strange that this accident does not occur more frequently, especially in consideration of the characteristic structure of the uterine walls, and the alterations which have taken place in the pelvic blood-vessels and tissues during pregnancy. The conservatism of Nature is to be thanked for the escape of so many puerperal women.

Mechanism.—The three processes which prevent post-partum hemorrhage from occurring more frequently than it does are (1) changes in the vessel walls, (2) changes in the muscle-fibers of the uterus, and (3) changes in the blood. In pregnancy the blood-vessels of the uterine walls and of the broad ligaments and pelvic fascia are enormously dilated. In the uterus the vessel-walls grow very thin, and the external coats are gradually absorbed, until at the end of pregnancy the intima alone is left, which is surrounded by the hypertrophied muscle-fibers. The muscular fibers as pregnancy advances arrange themselves longitudinally in rows so as to form canals, in which the vessels run to join with the placental vessels. Besides the longitudinal arrangement of the fibers parallel with the vessels, the fibers in the latter months of gestation arrange themselves so as to form strong circular bands or sphincters encircling the vascular trunks. Thus each vessel runs in a muscular canal made up of contractile smooth muscle-fibers, and, in addition, falciform, sphincter-like bands of the same contractile fibers encircle several vascular trunks. This is well represented by a package of cigarettes. There each individual cigarette is surrounded by its paper cover and the whole pack by its strong cover. This arrangement permits perfect obliteration of the blood-channels by uterine contraction. Besides, the intima is very elastic, which gives the vessel-wall the property of contractility, by which the ragged edges of the sinuses retract into the substance of the uterus which covers them and stops up the apertures. The third process in Nature's conservatism is the increased coagulability of the blood. The blood-current is slowed in the great sinuses, and, owing to this and the extreme thinness of the vessel-walls, there is a marked tendency to diapedesis of white blood-corpuscles which proliferate in the connective tissue around the vessels and add their part to the obstruction of the lumina. When, therefore, the decidua separates, this process hinders hemorrhage. On the other hand, there are (1) cases in which the uterus will remain comparatively large and flaccid and still no flooding result. (2) In many cases alternate contraction and relaxation of the uterus will take place after labor, and still no hemorrhage occur. This leads to the consideration of another preventive factor—thrombosis. In these cases of incomplete or partial contraction of the uterus the organ has sufficiently contracted to allow of the formation of coagula in the mouths of the uterine sinuses, so that when the uterus again relaxes, these openings are plugged by coagulated blood.

Etiology.—*Predisposing Causes.*—Among these is the hemorrhagic diathesis. Some women are by nature "bleeders," and all through their pregnancy, parturition, and puerperium they are subject to hemorrhage. Certain conditions of

the mother's blood, as albuminuria, extreme malarial poisoning, leucocythemia, and alcoholism, strongly predispose to hemorrhage. Certain conditions of the liver, heart, and lungs which retard or obstruct the return circulation are also predisposing causes. It is more common in multiparæ than in primiparæ; in 2200 confinements, I found this hemorrhage twice as frequent in the former (60.57 per cent.) as in the latter (33.65 per cent.). It is apt to occur in those in whom menstruation is generally profuse—in women of a delicate constitution. Thus it is seen among the rich rather than among the hard-working classes; in delicately nurtured women who have cultivated the emotional at the expense of the physical. It also occurs in women of the temperate zones who have taken up their residence in the tropics and have become debilitated by the warm climate. Irregularities in the maternal forces, such as precipitate or protracted labor, also lead to post-partum hemorrhage; so does overdistention of the uterus, as in multiple pregnancies and hydramnios. Certain conditions of the muscular walls of the uterus, degenerations, tumors; or malposition of the organ, partial or complete inversion, also favor post-partum hemorrhage.

Exciting Causes.—Foremost among these is the improper treatment of the second and third stages of labor. This complication is, almost without exception, the attendant's fault, and applies to the too rapid emptying of the uterus, as in extraction in breech presentations, and the use of forceps, cranioclasts, or cephalotribe, or by too rapid extraction after turning, and the excessive use of anesthetics—chloroform or ether. Here also belong efforts on the part of the attendant to hurry delivery by uterine compression, and injudicious voluntary efforts on the part of the patient during the second stage; as, for example, too forcible bearing-down during the hard pains. Mental emotions, such as anger, fright, anxiety, and such disturbances as coughing, laughing, vomiting, defecation, etc., have been known to give rise to post-partum hemorrhage. A distended bladder or rectum often constitutes an exciting cause. The retention of the placenta, membranes, or blood-clots, or new growths in the uterus, may hinder its contraction. A uterus completely and permanently contracted cannot give rise to a severe hemorrhage. Other factors are: uterine apathy; imperfect development of the organ or a deficient nerve-supply to it; adherent placental tissue; a large pyosalpinx, hydrosalpinx, pelvic exudate, old adhesions of the peritoneal surface of the uterus, or any mechanical obstruction to uterine contraction. Placenta prævia may be the cause of post-partum hemorrhage, for the lower uterine segment has not the power to contract that the upper part of the organ has, hence when the placenta is attached here the open mouths of the vessels do not close so quickly.

Symptoms.—The symptoms in many cases come insidiously—all may apparently have gone well, and the placenta expelled naturally, but soon after, the first symptom perhaps will be a complaint from the patient that she "feels faint," and that "something is flowing away from her." This warning should never be disregarded, and an immediate examination should be made. There may be only a slight discharge or the blood may be escaping in torrents. On palpating the uterus it is found to be soft, flaccid, and flabby, rising to and perhaps above the umbilicus, and presenting hard, irregular prominences which shift their position under a firm grasp. These are blood-clots within the uterus. In the more severe cases in which uterine inertia is complete, external palpation will not discover any uterus at all. Alternate contractions and relaxations of the uterus, together with pain and tenderness when the fundus is firmly grasped, are certain signs of hemorrhage from atony of the muscular fibers. There may be slight open or external hemorrhages taking place for

some time before any general symptoms are produced, and the patient not complaining, the physical signs will be overlooked. In extreme cases, however, of the concealed or the open variety, the general symptoms of shock and collapse set in, and it seems impossible to cause the uterus to contract immediately. In sudden profuse hemorrhages death may occur within two or three minutes. Frequency of the pulse-rate and decreased force are valuable danger-signals of the condition, and when observed should demand a careful examination of the uterus and the discharge.

Diagnosis.—The diagnosis is generally plain, especially when the bleeding is external. It is different when the blood accumulates within the uterine cavity, which constitutes the concealed variety, for although there are then the symptoms of syncope and collapse and a more or less rapidly enlarging abdomen, yet these symptoms and signs may be present without internal hemorrhage. (1) *Syncope* occurring after labor does not always depend upon loss of blood. It is often observed after precipitate and very rapid labors, for in these cases the uterus is so quickly emptied that the pressure to which the abdominal vessels has been subjected in the last two months of pregnancy is suddenly removed; the circulation in them becomes free and unobstructed and there is a rapid determination of blood from the upper part of the body, giving rise to cerebral anemia and fainting. When this occurs, raising the foot of the bed and the application of a moderately tight abdominal bandage will usually relieve the condition. (2) *Enlargement of the abdomen* may be owing to the fact that the intestines, being suddenly relieved of pressure and distended by gas, cause the abdominal wall to swell up nearly to its previous size. But in this case careful physical examination by palpation, percussion, and vaginal touch will readily determine the true state of affairs. (3) An *hysterical attack* coming on immediately after labor may be mistaken for the general symptoms of hemorrhage; but physical examination will again distinguish the well-contracted uterus in the hypogastrium. (4) *Lacerations* of the cervix causing rupture of the circular artery or lacerations of the genital tract below the cervix may be mistaken for post-partum hemorrhage. In these cases there will be a firmly contracted uterus. If any doubt exists, a speculum can be passed and the bleeding point treated. If the hemorrhage does not occur within ten or fifteen minutes of the birth of the child, it is not usually due to cervical or vaginal tears. Engel (1840), Schraeder, Virchow, Valenta, and Olshausen have described a dangerous variety of hemorrhage: viz., in cases in which, although the rest of the uterus is firmly contracted, the place of placental insertion does not participate, and there results what might be termed paralysis of the placental site. The part involved is driven down into the uterine cavity by the uterine parenchyma which is contracted about it like a ring, and thus a sort of tumor is formed which projects into the uterine cavity, and at a corresponding point upon its external surface a depression may be made out by careful palpation. This variety is particularly dangerous, because, the greater part of the uterine globe being firmly contracted, this small relaxed part may escape observation. Rarely an uncontrollable post-partum hemorrhage occurs from a firmly contracted and uninjured uterus. One case is on record in which it occurred from an aneurysmal vessel; another from a rupture hematoma of the cervix; and a third from a lacerated varicose cervical vein. These complications are said to be more common in high than in low altitudes on account of lessened atmospheric pressure (Hirst).

Prognosis.—The prognosis is doubtful, as it depends on several factors. It is the graver, the earlier the hemorrhage takes place. There is great danger in

that variety in which by the formation of a vaginal or cervical clot or the introduction of a tampon it becomes hidden. If the blood is like serum, not clotting, there is immediate danger of death. Pain in the back is taken as an encouraging sign indicating uterine activity. Other things being equal, the prognosis is more dangerous in the internal variety than in the external, for in the former the flow is apt to escape detection. There, again, the prognosis will vary depending on the completeness of the uterine inertia, and whether the patient is to have immediate and skilful treatment, for a very few moments may decide

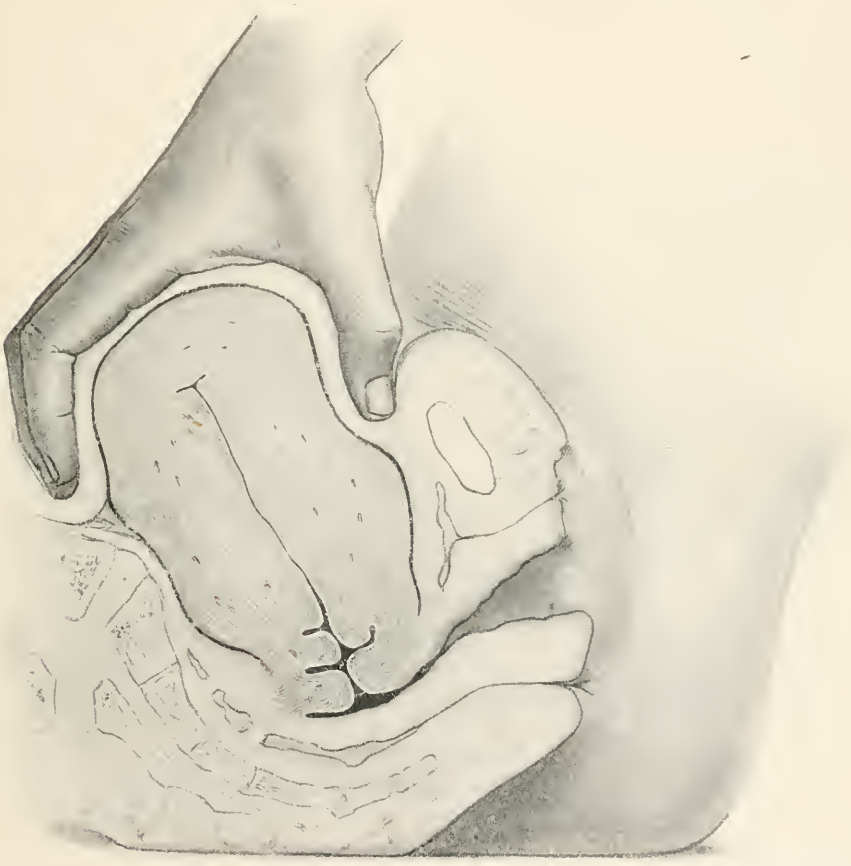

FIG. 779.—COMPRESSION OF THE FUNDUS FOR THE EMPTYING OF THE UTERUS AND THE CONTROL OF POST-PARTUM HEMORRHAGE.

the patient's fate. The late results of the hemorrhage are the same as those from any severe hemorrhage.

Treatment.—*Preventive.*—In case the pregnant woman is suffering from albuminuria, leucocythemia, or alcoholism, the condition should be treated, so that when the time of delivery draws near, the nervous, muscular, and circulatory systems of the patient may be in as good a condition as possible. All causes of obstructed venous return should be sought out, whether resident in the liver, heart, or lungs, and remedied as far as possible. Women worn out with frequent child-bearing and the attendant nursing and anxiety should

be strengthened by iron, fresh air, nourishing food, and moderate exercise. When there is reason to fear precipitate labor, the patient should not go about without a nurse properly qualified to manage the delivery. In attending such a case before the child's birth, delay should rather be encouraged so that the uterus may not be emptied too rapidly and the danger of uterine inertia increased. In cases of protracted labor the physician should not delay till the patient is exhausted before he renders assistance. A case of hydramnios should not run too far; rather should the membranes be ruptured when labor appears about to progress smoothly. The most important part of the pre-

FIG. 780.—BIMANUAL COMPRESSION OF THE UTERUS FOR THE CONTROL OF POST-PARTUM HEMORRHAGE. The fingers of the left hand can, at the same time, compress the abdominal aorta.

ventive treatment is the proper management of the second and third stages of labor. The hand should not leave the fundus after the birth of the child till the placenta is expelled, and uterine contractions should be watched carefully afterward for at least an hour. Any disturbance of the patient during this time should be avoided, and the administration of a drachm of the fluid extract of ergot after complete emptying of the uterus adds to the safety and comfort of the woman. The placenta and membranes should be carefully examined after their expulsion. An abdominal binder should be applied immediately and the child placed to the breast within three hours of the completion of labor.

Curative Treatment.—The curative treatment is more satisfactory than that of any other obstetrical complication. The mechanism by which the condition occurs must be carefully borne in mind; whence it will appear that successful management must fulfill three indications: viz., (1) The uterus must be evacuated, (2) it must be made to contract completely; (3) the loss of blood and its consequences must be made good by measures directed to the relief of the acute anemia. (1) *Evacuation of the uterus:* The uterus in these

FIG. 781.—BIMANUAL COMPRESSION OF THE UTERUS. THE LEFT HAND, IN THE SHAPE OF A FIST, IS INTRODUCED INTO THE UTERINE CAVITY, AND THIS IS GRASPED BY THE RIGHT HAND THROUGH THE ANTERIOR ABDOMINAL WALL.

cases usually contains fragments of placenta, membranes, or blood-clots which must be brought away. Credé's movements (See Operations) are therefore instituted in the same manner as in the expulsion of the placenta (Fig. 779). In kneading the uterus the fundus is at the same time compressed, while the ulnar border of the operator's hand makes pressure on the abdominal aorta. The hand is introduced into the uterine cavity only when the Credé method fails in its purpose. (2) *Permanent contraction of the uterus:* The rules for bring-

ing this about are in part a continuation of the preceding. Compression of the fundus uteri and of the aorta is maintained, or Breisky's method of bimanual compression of the uterus may be employed alternately (Fig. 780). The uterine cavity should be douched with hot water, either plain or with the addition of 1 per cent. acetic acid. About one quart of water should be injected at a temperature of 120° F. (49° C.). In an emergency hot or cold vinegar may be used in place of the acidulated water. The alternate use of hot and cold water or ice has been advocated in these cases, but cold in the uterus is a depressant and adds to the shock of the hemorrhage. There is no objection, however, to the application of cold to the vulva. Another method of bimanual compression (Gooch's) is also recommended (Fig. 781). It consists in compressing the fundus with one hand while the other, tightly closed, occupies the uterine cavity. When for any reason the hand is introduced within the uterus, it should be withdrawn only during a contraction lest air entering a sinus cause fatal pulmonary embolism. The management thus far given should be sufficient in most cases to arrest all hemorrhage. It is eminently natural management, since it aids and imitates Nature's methods. However, it is not invariably successful, for a degree of atony sometimes exists which cannot be made to yield to mechanical excitation. If the styptic douche and Gooch's method are ineffectual, the uterine cavity and the vagina must be tamponed with gauze. (See Tamponade of Uterus, Operations, Part X.) The tampons should be removed in about six hours. As an adjuvant to the measures just described, ergotin may be injected subcutaneously. Styptics to the uterine cavity are contraindicated with the exception of those enumerated. (3) *Treatment of anemia and shock:* This is directed especially to the acute anemia and tendency to heart failure which are produced by loss of blood. If the severity of the symptoms is such as to warrant the most active treatment, the pillows are removed from the bed, the foot of the bedstead is elevated, and the patient's arms and legs are bandaged (autotransfusion). Warm saline infusion is then introduced into the rectum and subcutaneously beneath the breasts. (See Operations, Part X.) Stimulants must be used with care owing to their tendency to cramp the heart under these circumstances. Ammonia may be injected into a vein, and camphorated oil subcutaneously. Absolute quiet is demanded. Feeding must not be neglected in these cases. At first it may require limitation to sips of brandy and coffee every fifteen minutes; after some reaction has set in, beef-juice, panopeptone, mutton broth, etc., may be substituted. In case of vomiting the patient may be nourished by the rectum with enemata of hot water containing whisky and pancreatinized milk or panopeptone.

V. RUPTURE OF THE UTERUS.

Definition.—A partial or complete rupture of some part of the uterine wall occurring during pregnancy, labor, or the puerperium. So-called spontaneous rupture may occur during pregnancy from rapid stretching of the uterine walls or from cystic degeneration of the chorion. These latter ruptures are very rare and result almost invariably from traumatism. Intra-partum rupture is rupture of the uterus proper. Rupture may also occur during the puerperium from a dissecting metritis in septic conditions, or from sloughing following prolonged pressure of the fetal head during labor. This is also very rare and is nearly always traumatic, *e. g.*, from post-partum curettage.

Frequency.—It occurs about once in 1000 cases of confinement. A case might not be met with in a decade, while, again, one observer might see two in the same day. However, this accident is far more frequent than is generally

stated. A great proportion of those in private practice which end fatally are reported as post-partum hemorrhage or as septic peritonitis. It is only in maternity hospitals that anything like correct statistics can be compiled.

Pathology.—On account of the general right obliquity of the uterus, the retraction is greater on the left side than on the right. In shoulder presentation, also, the head is most often on the left. These facts probably explain the general direction of the ruptures and their greater frequency on the left side. The cause for the frequency of rupture on the posterior wall is the direction of the force of uterine contractions. When the rupture is in the lateral wall, the peritoneum is generally felt intact, for its attachment in this situation is loose and the folds of the broad ligament near the uterus are separated to a certain degree by the growth of that organ during pregnancy. As a rule the edges of the rupture are not clean-cut, but are rough and jagged, and the direction is often oblique (Fig. 783). The prevailing low situation of the rupture depends on the greater distention and thinning of this part of the uterus during labor (Figs. 530 and 531). The degree of the tear varies from the size of a finger-tip to an opening large enough for the fetus to pass through. A transverse rupture sometimes embraces all or nearly all of the circumference of the organ (Fig. 783); a longitudinal or oblique tear may extend downward into the vagina or upward into the fundus of the uterus (Fig. 782). If the rupture is quite large and the uterine contents are evacuated, the upper part of the organ firmly contracts, while it is forced out of its normal position by the fetal body, which lies in the abdominal cavity. The manner of escape of the fetus varies in different cases. In a large tear it, together with the placenta, may be extruded into the cavity; or, again, if its head is impacted in the pelvis, it may be only the trunk and extremities which lie outside the uterus. In some cases the placenta remains in the uterus and is delivered through the vagina. *Incomplete rupture* consists of partial or almost complete rupture of the muscular coat. *Complete rupture* involves muscle and peritoneum. From the former may result extrauterine and extraperitoneal hematocele. Very rarely rupture of the peritoneum alone occurs. The complete rupture consists in a communication between the cavities of the uterus and peritoneum. The rupture is called *complicated* when there is associated an injury of a neighboring organ; for example, an opening into the bladder or intestines.

Etiology.—Among the *predisposing causes* are disproportionate size of the head and pelvis, stretching of one side of the lower uterine segment from lateral displacement, and any force which tends to twist the organ upon its longitudinal axis. Schuchard (1884) found among 73 cases of hydrocephalus, 14 cases of rupture of the uterus. A shoulder presentation is responsible for a large proportion of cases of rupture of the uterus, and it is possible for the cervix to be so rigid that rupture occurs before the cervix yields. Contributory causes of rupture are anything which narrows and makes rigid the cervical or vaginal canals (healed fistulæ or lacerations, new growths, etc.); pathological change in the uterine tissue (syphilis, soft myoma, carcinoma). Placenta prævia may also act as a cause. The scar of a previous Cæsarean section has been known to be a cause. Rupture occurs seven times as often among multiparæ as among primiparæ. Among 19 cases Bandl found 2 primiparæ, and others have given the percentage of primiparæ as 12 or less.

The *exciting causes* include the unintelligent use of ergot. A number of cases of rupture have occurred from intrauterine manipulation, curettage, version, extraction of placenta, etc., criminal abortion. Rupture occurring during pregnancy is due to some pathological change in the uterine wall or

to a new growth. Wittrow (1891) reported a case of rupture from external violence. The peritoneum and the muscular coats were torn but not the mucosa. Cases of rupture have been reported which occurred after the placenta was removed, from clumsy and violent manipulations by the accoucheur or midwife. The site of the rupture is usually lateral and on the left side, corresponding to the position of the vertex. The body of the organ is seldom torn. There are two methods in the mechanism of spontaneous rupture: (1) Rupture by

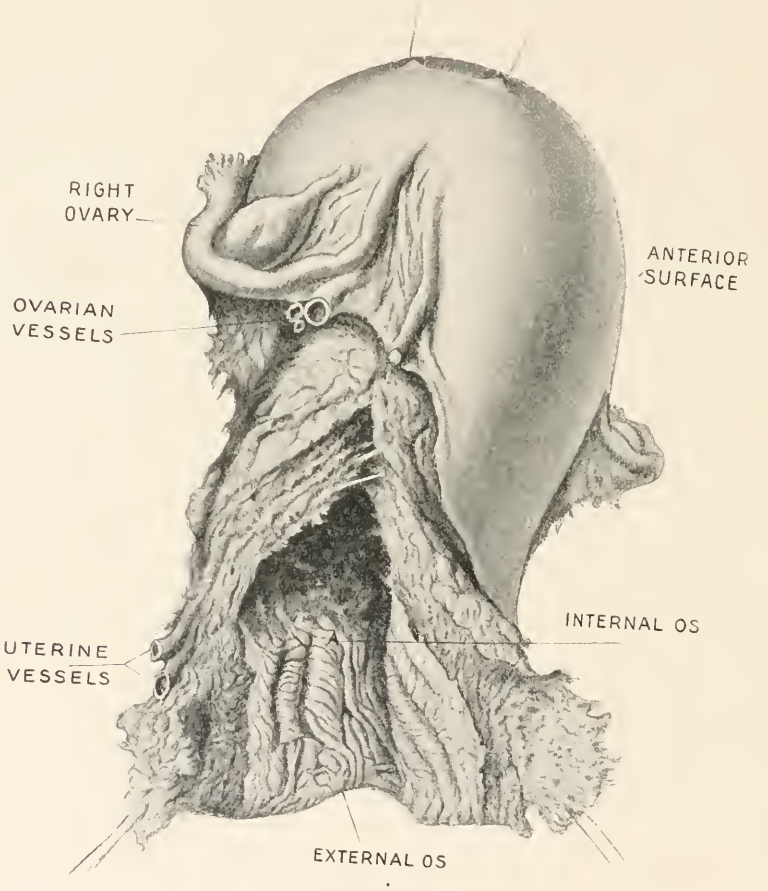

FIG. 782.—LONGITUDINAL RUPTURE OF THE UTERUS, FOLLOWING MANUAL DILATATION OF THE OS IN PLACENTA PRÆVIA. Tearing of the main branches of the uterine artery and death from internal hemorrhage. Note that the cervical canal and the limit of the internal os are still present.—(*Author's case.*)

thinning of the lower segment. In proportion to the variation between the expelling power and the resistance, thinning of the lower segment takes place while it closely hugs the enclosed fetus until rupture occurs. (2) Rupture by compression of the uterine wall. The wall sometimes ruptures from the compression to which it is subjected between the bony pelvis and the presenting part.

Symptoms.—*Impending:* The most characteristic symptoms are the ascent

of the contraction ring and the tension and tenderness of the round ligaments. Pulse and temperature may not be changed, but the patient may develop great anxiety and restlessness. Thickening of the upper portion of the uterus, and a transverse groove across the lower portion, can often be recognized through the abdominal wall, the latter just above the pubis. The uterine contractions will be strong or even tetanic, in either case accompanied by intense pain. There is often a history of previous prolonged, obstructed labor due to pelvic

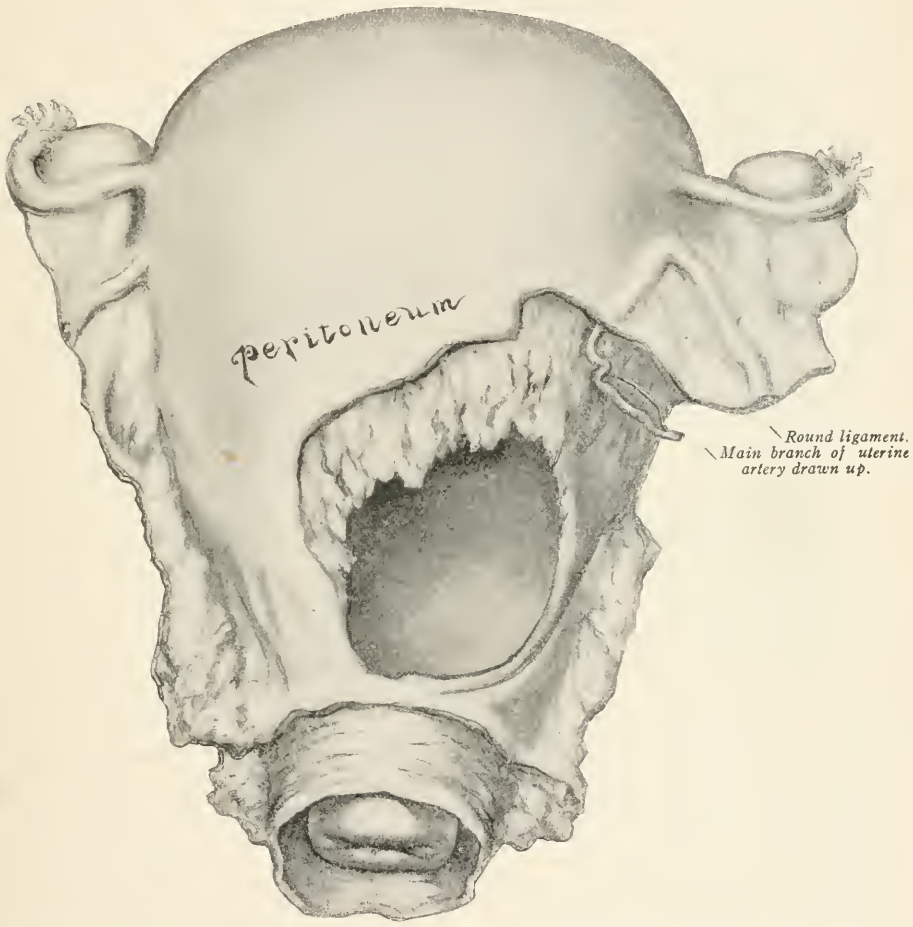

FIG. 783.—TRANSVERSE OR OBLIQUE RUPTURE OF THE UTERUS AND TEARING OF A MAIN BRANCH OF THE LEFT UTERINE ARTERY. Death from internal hemorrhage and shock a short time after being received into the Emergency Hospital. Case had been treated for inertia with ergot by a midwife.—(*Author's case.*)

deformity, with entire escape of the liquor amnii causing dry labor. The *symptoms of rupture* are very characteristic, especially when complete. There is a sharp, acute pain; a sudden cry from the patient; sometimes a sound of tearing tissue; followed by immediate collapse and symptoms of internal hemorrhage. External hemorrhage, recession of the presenting part, prolapse of the intestines, and subperitoneal emphysema are sometimes present. Collapse is soon marked, the pain severe, the pulse small and rapid, the patient

usually vomits and the uterine contractions cease, though the latter is not an invariable occurrence. In the case of a head presentation the head often recedes from the pelvis even if it is already engaged. In shoulder presentation the head may sometimes be felt through the tear, and it will be noted that the form of the uterus has suddenly altered. In some cases the fetus may leave the uterus entirely and may be palpable through the abdominal walls. Even in rupture of considerable extent the hemorrhage may be slight or even absent, and there may be no external evidence of it, especially when the head is firmly engaged. The claim that collapse after delivery means rupture of the uterus is sound, but there are cases in which there is extensive rupture without collapse, and such conditions are readily unrecognized. Patients have often experienced a sensation of tearing, and in several instances have described it to me as of "something giving way." The hemorrhage which nearly always occurs may be external or internal. In proportion to the severity of the hemorrhage will the symptoms be grave. Symptoms of peritonitis come on very quickly. Terminations are: (1) cicatrization and healing; (2) rapid death from hemorrhage and collapse; (3) retarded death from peritonitis and septicemia.

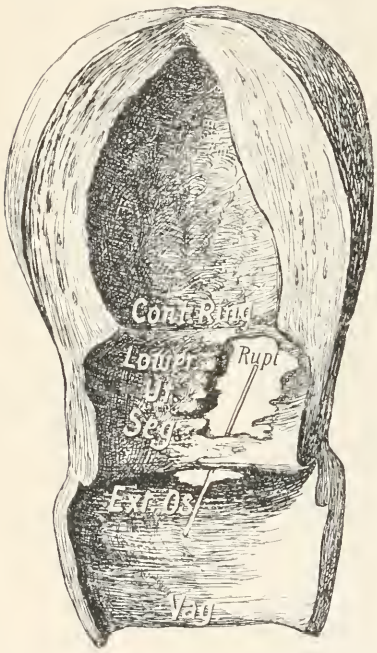

FIG. 784.—COMPLETE RUPTURE OF THE UTERUS INVOLVING LEFT LATERAL AND POSTERIOR WALLS AND EXTENDING FROM THE CONTRACTION RING ALMOST TO THE EXTERNAL OS, WHICH LATTER IS INTACT. Also complete rupture of posterior vaginal wall just below external ring, opening into Douglas's pouch.—(*After a specimen in the Museum of the Munich Frauenklinik.*)

Diagnosis.—When the foregoing symptoms have made their appearance, physical exploration will confirm the diagnosis. (1) Auscultation shows cessation of fetal heart-sounds, as the fetus generally dies. (2) Vaginal palpation is normal as long as the fetus is still within the uterus, but if it has passed partly or completely into the abdominal cavity, the presenting part is out of reach. (3) Abdominal palpation: The uterus preserves its form if the fetus remains in it. Pressure increases the pain at the point of rupture. The painful region may be emphysematous. If the fetus has escaped partly or completely into the abdomen, there will be two tumors—one the fetus, and the other the retracted uterus. (4) Direct examination of the uterine cavity. The location and extent of the rupture may be discovered in this manner. Sometimes there is hernia of the intestine which becomes strangulated in the uterine wound. There are cases of uterine rupture which would have been overlooked if the physician had not been obliged to deliver artificially. The condition may be confounded with placenta prævia and accidental hemorrhage. (Pages 214 and 224.)

Prognosis.—This is the most serious complication in obstetrics; the maternal mortality may be placed, in complete rupture, at 90 per cent.; the fetal mortality at 95 per cent. Maternal death is due to shock, primary or secondary hemorrhage, peritonitis or septicemia; fetal death is due to asphyxia from interference with the placental circulation. The foregoing maternal mortality is esti-

mated from the unrelieved cases. This is diminished under modern methods of treatment, being placed at from 55 to 60 per cent. One reason for the very unfavorable course of most cases is that the patients are already seriously weakened and usually infected before the accident occurs. In incomplete ruptures in which the peritoneal coat is not torn the prognosis is naturally much more favorable than in the complete, and they occur more frequently than is generally supposed. Rupture may occur also down to the mucosa from the peritoneal side. Anterior ruptures may also involve the bladder, and are therefore more serious. The gravity of the case is increased by complications. If the rectum or bladder is lacerated, there will be an escape of the contents into the surrounding tissues. There may be hernia or incarceration of the intestine with subsequent gangrene. There may be rupture of an hematocele, and death from hemorrhage or septic peritonitis may follow the suppuration of this mass.

Treatment.—*Prophylactic Treatment.*—This is most important. All cases having obstructed or prolonged labor from any cause must be watched for tetanic or cramp-like action of the uterus, retraction, or dangerous thinning of the lower uterine segment, in order that artificial aid may be given before rupture actually occurs. When rupture is threatening, the strength of the labor pains must be diminished by chloroform or morphin and any malposition of the uterus or fetus must be corrected. All obstetrical work must be carried out with the greatest caution, especially the application of the forceps. Some cases will demand perforation; some in which the presentation is a shoulder, may require decapitation, invariably or only when the child is dead. Version is usually attempted when the child is alive. Cæsarean section may be required when rupture is threatening and delivery does not seem practicable by other means. In nervous patients with a tendency to tetanic contraction of the uterus the wise use of anesthetics will often result in a favorable course. When slight pelvic contraction has been diagnosticated, the state of the uterus during its contractions must be carefully watched; and as soon as the contraction ring rises, labor should be quickly terminated by forceps or craniotomy. Decapitation is the only allowable method in neglected shoulder presentation. In all cases where rupture is impending, labor must be ended by the method safest to the mother, regardless of the fetus. If the head is immovable, the use of the forceps is in order. But if the head is movable and version contraindicated, the forceps will most likely injure both mother and child. All violent manipulations should be avoided. In threatened rupture, embryotomy is preferable to version, for the introduction of the hand as well as the turning of the child is very dangerous when the uterus is in this condition. In cases of hydrocephalus perforation is indicated. The chief complications which are followed by danger of rupture are contracted pelvis, hydrocephalus, and shoulder presentation. If in neglected shoulder presentation version is suggested, it should be ascertained whether the fetus is still living. In order to make this certain the hand, if possible, should be passed up almost to the shoulder and the cord palpated for pulsations. Version is not performed in case of a dead fetus.

Curative Treatment.—If rupture has already occurred, no disinfecting douche is to be used, and the rupture must not be allowed to increase. Version must not be attempted in the presence of a rupture with the fetus still in the uterus. The rupture might be made larger and the perhaps untorn peritoneum torn through. If the fetus is partly protruding into the abdominal cavity, delivery is still possible through the vagina, but it is an uncertain operation. Most authorities agree that laparatomy is the best treatment for the majority of cases, though Braun thinks that some can be treated by uterine tamponade, when the

tear is not too great, when the placenta remains in the uterus, and when there is no sepsis. I regard the prognosis as almost always justifying laparotomy in uterine rupture. I believe laparotomy to be indicated in all cases of complete rupture and when there is serious hemorrhage from an incomplete one. Sepsis is always an indication for laparotomy.

When celiotomy is done for a septic indication the peritoneum must be protected at all hazards from the septic contents of the uterus. The operator is next confronted with the alternative: Shall he save the uterus or extirpate it? The indications for extirpation are: (1) Evidences of infection; (2) presence of extensive contusions and extravasations in the uterine wall; (3) presence of extensive laceration of the uterine supports, especially the broad ligaments. If these conditions are absent, the rent in the uterus should be sutured. Suture of the uterus must be done with extreme care, and if the lips of the wound are ragged, contused, or necrotic, they should be resected. The sutures should involve only the serous and muscular coats (see Technique of Cæsarean Section, Part X.) Many successful cases of suture have been reported. The uterine tissue may be so friable that suture of any kind is out of the question. Under these circumstances the organ should be extirpated. The after-treatment is like that of an ordinary hysterectomy. Various statistics give a mortality rate for the operative treatment of uterine rupture at from 25 to 50 per cent. Abdominal hysterectomy, if the patient is in fair condition, in these days of antiseptic surgery is attended by very good results.

Incomplete ruptures treated by tampon must also be treated by external abdominal pressure. This method of tamponade is said by some to make possible a subperitoneal hematoma, and pressure assists in preventing this. Ruptures extending upward into the supravaginal portion of the uterus are especially liable to be accompanied by serious hemorrhage, from which placenta prævia is to be differentiated. The hemorrhage from such lacerations may be very troublesome and dangerous, and it may be necessary to open the posterior vaginal fornix and clamp the broad ligaments in much the same way as in a vaginal hysterectomy.

Summary of Treatment.—(1) Curative treatment should always be prompt and active; expectant treatment is usually fatal to the mother and always to the fetus; the fetus must be delivered by some method—podalic version, forceps, or craniotomy if dead—that will cause as little shock as possible. (2) A careful examination of the position and extent of rupture must be made. (3) If the latter is small, low down, posterior, and meconium and clots have not escaped into the peritoneal cavity, the uterine cavity must be freely irrigated with warm sterilized water, and a good-sized strip of sterile gauze passed to the fundus, a firm abdominal binder applied, full doses of ergot administered, and the case treated expectantly. One should be prepared for laparotomy on the first indication of peritonitis. (4) Large ruptures with escape of the fetus into abdominal cavity, and ruptures high up in the uterine wall, are best treated by removing the child by the natural passages if possible and immediately performing laparotomy and hysterectomy, or, instead of the latter, Sänger's operation.

After-treatment.—The after-treatment is upon general principles. If recovery follows and subsequent pregnancy occurs, it should be terminated at the thirty-sixth week to avoid spontaneous rupture.

VI. INVERSION OF THE UTERUS.

Definition.—By inversion of the uterus we mean a complete or partial turning of the uterus inside out. It may occur before or after the delivery

of the placenta. It is the rarest of all complications of labor, occurring once in 200,000 cases, and may be partial or complete. It generally begins by a slight depression of the fundus. In a hospital experience of many thousand cases of confinement one case of complete inversion has occurred. I have seen in consultation practice several cases of partial inversion.

Etiology.—It is most common in primiparæ and is due to the so-called paralysis of the placental site, too vigorous compression of the fundus, or traction on the cord. Mismanagement is generally responsible for this complication. Other causes are sudden delivery, especially when the patient is standing and the uterus relaxed; exertion after delivery, such as coughing or straining; heavy pressure on the fundus from above; or a short cord, from whatever cause. The uterus must be relaxed, for inversion of a well-contracted uterus is almost inconceivable. This accident generally takes place during the third stage

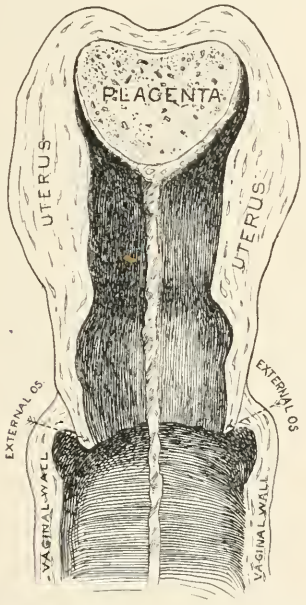

Fig. 785.—Beginning Inversion of the Uterus.

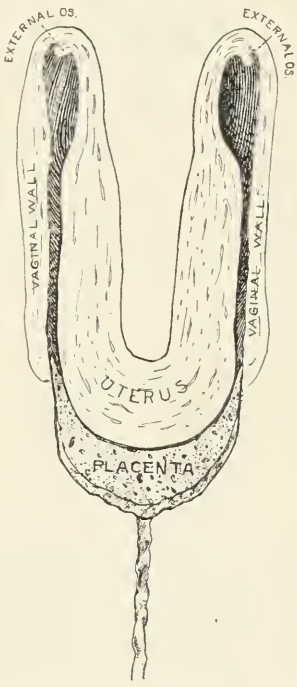

Fig. 786.—Inversion of the Uterus.

of labor, although rarely it may happen days after delivery. In very rare cases it may occur without reproach to the physician.

Symptoms.—These are acute pain, hemorrhage, and shock; imperceptibility of the fundus through the abdominal wall and a cup-like body in the vagina or protruding through the vulva (Figs. 785, 786). The hemorrhage may be slight or profuse according to whether the uterine sinuses are closed or open. There is a rapid, thready pulse, the skin is clammy and pale, and nausea, vomiting, and even syncope may occur. Reflex cardiac paralysis and cerebral anemia may result. Most rarely this complication may occur with no apparent symptoms.

Diagnosis.—Inversion may be confounded with uterine polyp. The latter is insensible and does not contract on examination, and its pedicle may be traced upward through the os uteri into the cavity and demonstrated with a sound. The patient should be catheterized to set aside the possibility of

a distended bladder. If the physician is present when the accident occurs, and if the placenta is wholly or partially attached to the uterus, the diagnosis is clear. The opening of the tubes may be seen on the lower part of the tumor. The uterus is generally particularly sensitive and contractile. An inverted uterus can always be half reduced; polyps cannot. Rectal examination will detect absence of the uterus from its normal position.

Prognosis.—Mortality is as high as 50 per cent. Death, due to either hemorrhage or shock, often occurs soon after the accident (within half an hour). It may also be caused by incarceration of an intestinal loop in the inverted uterus, by peritonitis, by puerperal infection, or by gangrene. Cases are on record in which recovery has taken place after the uterus has sloughed. A few cases in which manual reposition was not accomplished were spontaneously restored. The prognosis depends largely upon prompt reduction of the organ, as delay increases the danger and difficulty. Prognosis should always be guarded.

Treatment.—The accident can usually be avoided; hence the prophylactic treatment is most important. Precipitate expulsion of the fetus should be prevented and unnecessary force in Credé's method and in traction upon the cord avoided. Curative treatment consists in the immediate reduction of the tumor with the aid of anesthesia. The bladder and rectum should be emptied and reduction accomplished by taxis, followed by intrauterine irrigation and tight intrauterine tamponade. The more quickly treatment is instituted, the more successful the result. When the placenta is completely adherent or nearly so, an attempt should be made to replace it with the uterus, although this is a disputed point. The fist should be placed against the inverted fundus while the other hand makes counter-pressure over the abdomen. If the placenta is almost separated or if it interferes with reduction, it must be entirely detached. When the body of the uterus has become swollen and congested, it is compressed either manually or by bandaging before it is reduced. If this is impossible on account of spasmodic constriction of the os, anesthesia may relax the spasm. Pressure firmly continued gives the best results. After reduction has been accomplished the uterus must contract before the hand is withdrawn, and if the placenta is still attached it should be separated. Some authorities advise, in replacing the uterus, to begin with that part which was last inverted. In cases in which the uterus cannot be restored without great shock to the patient, especially if she is not seen until several days have elapsed, the operation should be delayed temporarily. If the uterus cannot be returned, hemorrhage can be controlled by ergot and the local application of astringents, such as acetic acid, and stimulating contractions by putting the child to the breast.

VII. EXCESSIVE RIGHT LATERAL OBLIQUITY OF THE UTERUS.

Although it is a physiological fact that the uterus leans as a rule to the right side in pregnancy, this position is sometimes exaggerated so that much of the expulsive power is wasted by driving the presenting part against the lateral pelvic wall, resulting in delayed labor, malpresentations and malpositions, and even in uterine rupture (Fig. 783). Postural treatment by placing the patient on the left side is usually sufficient to relieve the condition.

VIII. LACERATIONS AND CONTUSIONS OF THE CERVIX, VAGINA, RECTUM, AND PERINEUM.*

1. **Lacerations and Contusions of the Cervix.**—The cervix is ruptured very frequently during labor, this accident invariably occurring in primiparæ. The

* Compare Operations, Part X.

scars resulting from lacerations of the cervix constitute one of the essential evidences of previous pregnancy (Fig. 123).

Etiology.—The mere act of labor itself is the cause of the milder degrees of

Fig. 787.

Fig. 788.

FIGS. 787 AND 788.—AUTHOR'S CASES OF ANNULAR DETACHMENT OF THE CERVIX. The left-hand figure was in the case of a generally contracted pelvis, and the other was due to incarceration of the anterior lip of the cervix between the advancing head and the symphysis.

laceration, the injury occurring during the expulsion of the head, shoulders, etc. Deeper tears have a different cause. There is usually a predisposition in the shape of organic rigidity. Precipitate or premature expulsion of the fetus before dilatation is complete and operative extraction under the same condition both produce extensive injuries. Many lacerations are due to forceps deliveries and version, but especially to the unskilful use of instruments.

Symptoms.—The vast majority of tears are longitudinal, involving the os, but circular lacerations have been described (Fig. 789). In one of the author's cases of anatomical rigidity the entire portio was torn from the rest of the uterus (Fig. 787). Ordinary longitudinal tears may be single, bilateral, or multiple, the latter being rare. Deep lacerations of the cervix may extend into the vaginal culs-de-sac (extraperitoneal rupture of the uterus). Finally, there is a submucous rupture, which is manifested by a patulousness of the os. Clinically the principal symptom of ruptured cervix is hemorrhage. In the deeper varieties some of the large branches of the uterine artery may be torn. Cervical lacerations often heal spontaneously during the puerperium. The *diagnosis* is made by careful inspection and palpation. As regards prognosis, after the cessation of hemorrhage

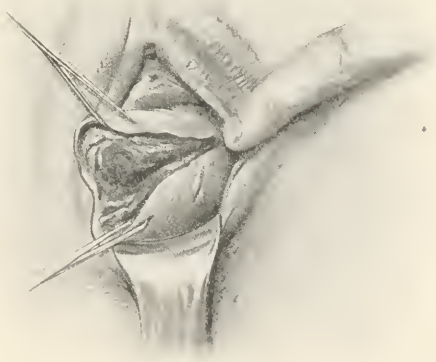

FIG. 789.—LACERATION OF THE CERVIX DURING LABOR.

there is still danger of infection, and of the development of cervical catarrh, with resulting tendency to abortion.

Treatment.—The prophylaxis consists in the utmost care in all operative procedures which involve either forcing or drawing the fetus through an imperfectly dilated os. In regard to treatment proper, hemorrhage must be arrested if profuse, and the best method is by immediate suture of the tear.

FIG. 790.—UTERO-VESICAL RUPTURE DUE TO SECONDARY INERTIA IN PERSISTENT OCCIPITO-POSTERIOR POSITION. *B*, *B′*, Bladder; *R*, rupture.

FIG. 791.—UTERO-VESICAL RUPTURE. ADVANCED DEGREE OF FIG. 790.

2. Lacerations and Contusions of the Vagina. (See Repair of Injuries, Part X.)—These injuries may be either spontaneous or artificial in origin. The lower third is implicated much more commonly than the rest of the passage. Next in order comes the upper third (culs-de-sac), and lastly the middle third.

Etiology.—Lacerations of the lower and middle thirds are due, as a rule, to the marked transverse distention of the vagina by the presenting part. These vaginal tears are usually longitudinal at the junction of the posterior with one of the lateral walls. Lacerations of the upper third are due to causes practically the same as those for rupture of the uterus, with which they are also clinically related. Submucous rupture is usually due to the sudden descent of the head in precipitate labors and forceps extractions. Many lacerations occur from operative delivery. A special form of injury to the vagina—a contusion rather than a laceration—is seen in the upper third in certain deformities of the pelvis in which bony projections encroach upon the excavation. Thus the ischial spines project into the funnel-shaped pelvis and the crest of the os pubis in exostosis pelvis. The vagina then becomes incarcerated between the fetal head and the bony prominence. Similar contusions are seen when the fetal head is arrested in a narrow pelvis, and if the bladder is incarcerated between the fetal head and the symphysis a vesico-vaginal fistula may result. (Figs. 790, 791.) Ruptures in the upper third of the vagina may originate from mere extension of cervical lacerations into the culs-de-sac, or they may begin in the vagina itself, usually the posterior fornix. These injuries, unlike those of the lower and middle

thirds, run chiefly in a transverse direction. In the most serious types the vagina may be torn across—the so-called "colporrhexis." The vagina may also be separated from the uterus as a result of longitudinal stretching, which results when the uterus with the cervix is drawn upward over the presenting part. This condition is seen at times in certain presentations, such as shoulder or head in narrow pelves. Spontaneous rupture of the posterior cul-de-sac has been seen in connection with pendulous abdomen, congenital shortening and various acquired alterations in the vagina. Introduction of the hand into the vagina in the performance of version is a very common cause of rupture. The same may be said of the application of the forceps. Injuries of the anterior fornix are also almost always artificial.

Symptoms.—A peculiar form of laceration sometimes occurs in which the mucosa of the inferior vaginal segment tears slightly while the submucous tissue is extensively ruptured. Under these conditions a pocket is formed in which the lochial secretions may collect, with the formation of abscess and fistula. Lacerations of the middle and lower third are accompanied by hemorrhage and may be followed by infection or by the formation of urinary or fecal fistulæ. Hemorrhage is seldom profuse unless the tears extend into the paravaginal tissue. Lacerations of the ostium vaginæ extending upward by the side of the clitoris may provoke hemorrhages which threaten life. In extensive injuries, especially in the "pocket" ruptures already described, there may be high fever, stagnation and putrefaction of lochia, pelvic cellulitis, and general infection. Extensive injuries give rise to cicatricial stricture of the vagina.

Diagnosis.—Lacerations of the lower third which are continuous with vulval or perineal tears are diagnosticated by stretching the ostium vaginæ with the fingers, when the course and extent of the injury may be determined (Figs. 631 and 632). If, with vulva and perineum intact and uterus well contracted, arterial blood escapes from the vagina, it is evident that a laceration exists either in the cervix or in the upper third of the vagina. The uterus should be pushed into the lesser pelvis and drawn down with volsella forceps. It is common under these circumstances to see a deep laceration from the cervix into the fornix vaginæ. Transverse lacerations of the posterior cul-de-sac, which sometimes extend through the peritoneum, may be almost as grave in their consequences as rupture of the uterus. The clinical picture is much like that of the latter, and the diagnosis should be made with the hand in the vagina.

Treatment.—Deep lacerations recognized soon after delivery should be sutured. If the rupture forms a pocket in the submucous tissue it must be irrigated with antiseptics and packed with gauze. In severe contusions the vagina must frequently be irrigated in such a manner that the affected surface is kept clear of the lochial discharge. If fistulæ form, they sometimes close spontaneously under daily touching with nitrate of silver.

3. Lacerations of the Pelvic Floor.—These injuries comprise ruptures of the fourchette, posterior vulval commissure, perineum, lower third of the posterior and lateral vaginal walls, and the recto-vaginal septum. The tissues involved may include the integument from the anal orifice to the posterior vulval commissure, the mucous membrane of the vulva, vagina, and rectum, the cellular tissue, the sphincter ani and levatores ani muscles.

Varieties.—These lacerations exhibit many varieties and may be classified in various ways. The arrangement which is taught in most text-books is, however, only partially correct. It presents these injuries as occurring in three degrees, as follows: The mildest grade of rupture extends from the posterior vulval commissure for a variable distance into the perineal body; the second

degree extends as far as the sphincter ani, while in the highest degree the rupture involves the sphincter and the recto-vaginal septum. This mode of grouping takes no cognizance of lacerations of the vaginal sulci, which are the most fre-

FIG. 792.—ABRASIONS AND SUPERFICIAL TEARS OF THE VESTIBULE AND VULVA.—(*Redrawn after Bar.*)

FIG. 793.—ABRASIONS AND SUPERFICIAL LACERATIONS OF THE VESTIBULE AND VULVA.—(*Redrawn after Bar.*)

FIG. 794.—LATERAL VAGINO-PERINEAL RUPTURES WITH ABRASIONS OF THE VULVA.—(*Redrawn after Bar.*)

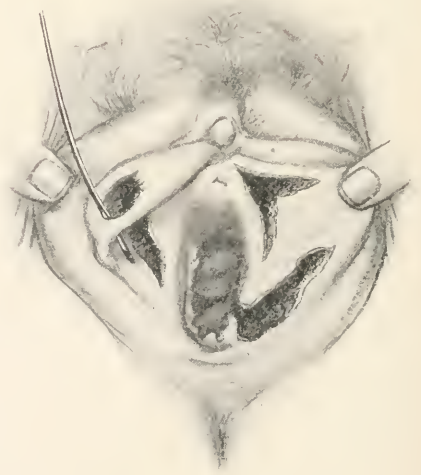

FIG. 795.—PERFORATIONS AND LACERATIONS OF THE LABIA MINORA AND VAGINAL INLET.—(*Redrawn after Bar.*)

quently occurring and the most important of all the accidents, owing to the participation in the rupture of the levator ani muscle. Central rupture of the perineum is described by most authors as an injury *sui generis*, as if it had no connection with the common varieties. It seems to me that the only way of classifying and naming these lacerations is that which takes cognizance of the precise tissues involved. Thus, ruptures of the pelvic floor are (1) lacerations, (2) submucous or muscular ruptures.

(1) *Lacerations* are (*a*) vulval (fourchette, posterior commissure); (*b*) vulvo-perineal; (*c*) vaginal (described under that head); (*d*) intraperineal (so-called central rupture) (vagina also involved); (*e*) lateral vagino-perineal (vulva involved), unilateral, bilateral; (*f*) postero-lateral vagino-perineal; (*g*) vagino-perineo-anal or rectal; (*h*) perineo-rectal (extension of central rupture into rectum). (*a*) *Vulval:* Abrasions and superficial tears of the vulva occur in most labors. (Fig. 792.) In 100 consecutive cases Auvard found 81 such lesions. In 49 cases there were accompanying lacerations of the perineum. In 32 the anterior and lateral parts of the vulva alone were involved. Tabs are frequently seen at the sides of the vulva after a difficult second stage. Buttonhole tears have been observed in the labia minora. In rare instances—only three or four are on record—the urethra has been involved. Most vulval lacerations are superficial and heal readily under antiseptic treatment. Lacerations at the side of the clitoris may bleed profusely. The chief danger, however, is from sepsis, since the vulva, unlike the vagina, is the habitat of the streptococcus and other pathogenic germs. *Fourchette:* This ruptures in primiparæ as a continuation of rupture of the base of the hymen. *Posterior commissure:* This is torn by extension of the hymen-fourchette laceration. Ruptures of the base of the hymen and fourchette occur practically in all first labors and are not included in the statistics of ruptured perineum. (*b*) *Vulvo-perineal:* In actual rupture of the perineum the mildest degree must involve the posterior commissure and extend for a variable distance into the perineal body. (See Part X.) (*c*) *Vaginal:* Rupture limited to the lower third of the posterior vaginal wall is described under the head of lacerations of the vagina (*q. v.*). (Fig. 799.) (*d*) *Intraperineal:* This is the so-called central rupture or perforation of the perineum. (Figs. 796 and 797.) The posterior wall of the vagina is extensively involved. Very rarely the entire fetus passes through such an opening. (Fig. 797.) It is a rare accident, but 75 cases being mentioned in literature. These ruptures may readily unite, but cases have occurred in which a permanent opening has resulted. (*e*) *Lateral vagino-perineal:* These represent a continuation of vulvo-perineal ruptures which extend into the vaginal sulci on one or both sides. (Fig. 794.) They are very common and produce serious results because the fibers of the levator ani may be included in the rent. When both sulci are involved a Y-shaped lesion is produced. (*f*) *Postero-lateral vagino-perineal:* This is the "perineal rupture of the second degree" of most authors. It extends to the border of the anus without involving the latter. (Fig. 794.) (*g*) *Vagino-perineo-rectal:* This is the "rupture of the third degree," or complete rupture—a rare accident. (See Part X.) As it extends through the anus and recto-vaginal septum, it produces fecal incontinence. There is little or no attempt at spontaneous repair. (*h*) *Perineo-rectal:* A very few cases of intra-perineal or central rupture have extended into the rectum.

(2) *Submucous or muscular ruptures* were first described by Schatz. They occur in patients with unusual elasticity of the skin of the perineum. When the latter is distended by the advancing fetus, the elastic integument readily yields, while the more rigid muscle is ruptured. (Figs. 798 and 799.)

Frequency.—It is usually asserted that some injury to the perineum results in 30 per cent. of labors in primiparæ and 10 per cent. in multiparæ. Such figures refer to maternities, where the prophylaxis of these injuries is intelligently managed. Doubtless in miscellaneous midwifery practice, in which the attendants include numerous midwives and untrained physicians, the figures would be considerably higher. Perineal lacerations are generally admitted to be the most frequent of all maternal birth traumatisms. In 1200 confinements at the Mothers' and Babies' Hospital, I found that perineal lacerations, requiring suture, occurred in 88 cases, or 7.33 per cent.; and in 1000 cases at the New York Maternity, in 211 cases, or 21.10 per cent. It is worthy of

FIG. 796.—CENTRAL OR INTRA-PERINEAL RUPTURE.—(*Lepage.*)

FIG. 797.—CENTRAL OR INTRA-PERINEAL RUPTURE.—(*Lepage.*)

note that in the first series, with a frequency of 7.33 per cent., nearly all the 1200 cases were used for clinical demonstration, students delivering the patients under the supervision of a hospital interne, while in the second series, with 21.10 per cent., no clinics or demonstrations were held, nor were students permitted to deliver the cases.

Etiology and Mechanism.—The predisposing causes of perineal rupture include unusual rigidity of the tissues, seen especially in elderly primiparæ, corpulence, œdema, and the peculiar friability of tissue seen in certain women. Exciting causes comprise rapid expulsion in normal labors, whether delivery is spontaneous or artificial. The birth of the suboccipito-frontal circumference of the

head is always a menace to the integrity of the perineum in cranial and breech positions, as is the occipito-mental in face presentation. The perineum is also menaced by the abrupt expulsion of the posterior shoulder in head presentations. The mechanism of traumatisms of the pelvic floor, I believe, is as follows: (1) When the remains of the hymen give way to the presenting part the laceration may extend to the fourchette, or, in a multipara, may begin in the latter. According to the circumstances in each case, the injury may stop at the fourchette or extend to a variable degree into the pelvic floor. (2) The rupture of the floor is simply a continuation of the vaginal laceration. (3) The mucous membrane is the first to yield, the tear extending into the subjacent tissue. Intraperineal or central rupture occurs, according to Budin, in primiparæ the residue of whose hymens is extraordinarily unyielding. In

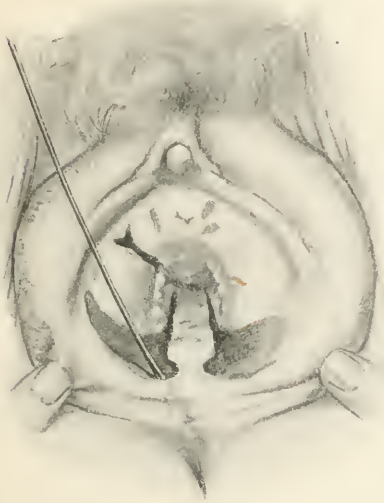

FIG. 798.—LACERATIONS OF THE VAGINAL SULCI AND SUBMUCOUS OR MUSCULAR RUPTURE OF THE PERINEUM. The integument over the perineum remains intact.—(*Redrawn after Bar.*)

FIG. 799.—SUBMUCOUS OR MUSCULAR RUPTURE OF THE PERINEUM. The integument over the perineum remains intact.

these cases the distended posterior vaginal wall ruptures, involving the entire perineum in the injury.

Diagnosis.—This is made by inspection and palpation, the parts being put on the stretch (Figs. 631 and 632).

Prognosis.—Rupture of the pelvic floor is a serious accident, especially when the muscles are involved. The bad results may be immediate or remote. The former include the possibility of septic infection, which can occur if the recent wound is not successfully repaired. An infected lochial discharge may interfere with union by second intention. The ultimate results of perineal tears when extensive and unrepaired are as follows: The anterior wall of the vagina which rests upon the intact perineum sags down, dragging the uterus with it. The ostium vaginæ becomes more patulous and allows the posterior wall of the vagina to prolapse. Rupture of the levator muscle also causes sagging of the pelvic floor. Incontinence of feces results from rupture into the rectum.

Treatment.—Prophylaxis: Preservation of the perineum has been placed by some authorities as second in importance only to preservation of the lives of the mother and child. From this standpoint it is possible to discuss the entire mechanism and conduct of labor with the one aim in mind of favoring the perineum under all circumstances when the more weighty conditions do not assert themselves. This has actually been done by Krantz.* The factors which bear directly and indirectly upon the state of the perineum are numerous, but for convenience we may make three major classes: (1) Anomalies of the expulsive forces; (2) anomalies of the soft parts,—vagina and perineum; (3) faulty presentations and positions of the child.

Curative treatment. (See Operations, Part X.)

IX. LABOR AFTER OPERATIONS INVOLVING THE GENITALS.

Pregnancy and Labor after Ventrofixation and Ventrosuspension.—These operations have now been performed many hundred times. Up to 1896 at least 808 had been done in America alone.† In this series of cases at least one ovary was left, and pregnancy followed in 56 (nearly 7 per cent.) of the patients. The mortality in the fifty-six pregnancies was less than 5 per cent., and but one of the three deaths could be attributed to the operation. The percentage of pregnancies terminating in abortion was 7. In a series of foreign operations ‡ comprising the results of 175 pregnancies, there were 10 per cent. of abortions and 2.25 of deaths. It is a matter for regret that in these joint statistics of 231 pregnancies no distinction is made between the older and more dangerous operation of fixation and the more recent and safer ventrosuspension. In the American series of 56 cases there were three forceps deliveries, two retained placentæ, and one induced labor, for uncontrollable vomiting. Hence, over 11 per cent. of the pregnancies (the abortions having been subtracted from the total) were dystocic. In the series of foreign cases the percentage of dystocic labors was exactly 14. These percentages are of course unfavorable in comparison with the results of labor under ordinary circumstances, and therefore some authorities § advise a careful forecast of the chances of dystocic births, and if such are imminent they counsel induction of labor at the eighth month. During the sixth month a series of examinations should be begun for the purpose of controlling the position of the cervix, which may be found to be drawn up out of the pelvis despite the apparently natural relations of the fundus. If the cervix is thus displaced, its anterior wall is said to constitute a tumor at the brim of the pelvis. According to Dickinson,‖ it is by no means easy to estimate the dimensions of this tumor. Bidone ** once forestalled the results of ventrofixation, when delivery seemed to be impossible, by performing laparotomy and dividing the adhesions which crippled the uterus. Judging from the favorable termination of the majority of cases of pregnancy following these operations, this resource of Bidone's is indicated only under very exceptional circumstances. As in cases of obstructive dystocia in general, the issue most to be dreaded in theory is rupture of the uterus.

* "Die Aetiologie d. geb. Dammverletzung," Wiesbaden, 1900.

† Gordon: "Transactions of the American Gynecological Society," 1896.

‡ Noble: "Transactions of the American Gynecological Society," 1896.

§ "Amer. Jour. of Obstetrics," 1901, XLIV, 40.

‖ Dorland and Noble: "Amer. Jour. of Obstetrics," 1897, p. 121.

** "Amer. Jour. of Obstetrics," 1901, XLIV, 40.

Dickinson,* who has had one fatality from this accident and who performed Cæsarean section in a subsequent case (of twin pregnancy), with a second fatal result, assures us that rupture of the uterus is a rare termination of these labors, and that but eight Cæsarean sections are on record in this connection. In both of Dickinson's fatal cases fixation of the uterus was present, although

FIG. 800.—MATERNAL DYSTOCIA FOLLOWING ANTERIOR FIXATION OF THE UTERUS. Shoulder presentation, in the left scapulo-anterior position; buckling of the uterus upon itself; elongation of the cervical canal; manual dilatation of the cervix followed by a difficult version and extraction, and delivery of a dead fetus.—(*Case seen by the author in consultation with Dr. Nathan G. Bozeman, of New York.*)

in the first example the operator had attempted to perform suspension. Ventral fixation as pregnancy advances may possibly result in what is practically a ventral suspension, by the constant dragging of the ever-enlarging uterus. A more serious termination, however, is the occurrence of marked expansion of the cornua, and an exaggerated anteflexion of the anterior uterine wall. The

* "Amer. Jour. of Obstetrics," 1901, XLIV, 34.

cervix is drawn upward and backward, even to the sacral promontory, and an elongation or supravaginal hypertrophy of the cervical canal results (Fig. 800). The internal os, then, may be found as high as the second or third lumbar vertebra. I saw a case of this character in consultation with Dr. Nathan G. Bozeman, of New York. The patient was at term, suffering from secondary inertia and exhaustion, with a dead fetus in the left scapulo-anterior position. After a difficult dilatation of the elongated cervical canal, I was able to seize the upper leg and gradually extract the child around the obstruction formed by the hypertrophied cervix and thickened fundus (Fig. 800).

Labor after Vaginofixation.—Ruhl * states that severe interference with labor may result from the fixation of the uterus at the anterior vaginal wall. Nevertheless, among hundreds of cases in which this operation has been performed, but 9 are on record in which labor had to be terminated by Cæsarean section; most of the labors having been uneventful. Ruhl was able to supply notes of 71 cases of vaginofixation followed by pregnancy. In 3 cases it was necessary to incise the anterior utero-vaginal wall, but in the others there were no difficulties attributable to the operation. Even in numerous cases in which the fundus was attached to the vagina, and in which trouble might have been expected, there were no complications of labor except in the three cases just mentioned. When the fundus is sutured to the vagina the former is deeply placed, the cervix has a high position and is retrodisplaced, the posterior uterine wall is upon the stretch, and the anterior wall is doubled upon itself. The fundus lies close above the symphysis. Labor under these circumstances pursues a peculiar course. Slight uterine contractions are noted days and even weeks before labor sets in, and finally the os slowly dilates. In these cases mechanical dilatation, as by the use of the colpeurynter, is of little benefit because of the unnatural position of the cervix. After prolonged waiting the os is sufficiently dilated for the introduction of the hand, but the latter can enter only in a cramped position, so that version, forceps, etc., are hardly practicable. Ruhl on two occasions inserted his entire hand and grasped a foot, but could not deliver the child. In a case in which Cæsarean section was performed the uterus was found strongly anteflexed, literally standing on its head, and the posterior wall was stretched almost to the thinness of paper.

MATERNAL DYSTOCIA FROM OBSTRUCTED LABOR.

X. UTERINE, OVARIAN, RENAL, AND PERITONEAL TUMORS.

General Considerations.—Tumors may produce either relative or absolute obstruction of the birth canal. In the former case the birth of a living child may be possible, either unassisted or with the aid of forceps or version. If the presence of the tumor is recognized during the course of gestation, extirpation may be possible; or if not, the pregnancy may be interrupted or artificial premature delivery performed. If the obstruction to delivery is absolute at term Cæsarean section or perforation must be the indication. While numerous forms of benign neoplasms may be present in the pelvis, the vast majority are either uterine myomata or ovarian tumors.

Uterine Myomata.—The association of these growths with pregnancy is not of frequent occurrence, perhaps because women thus afflicted are very

* "Monat. f. Geburts. und Gynäk.," XIV, p. 477.

often sterile. Hofmeier (1900) shows that the greatest fecundity occurs before the age of thirty-five, while myomata tend to appear after that period. When a woman with myoma becomes gravid, the tumor begins, as a rule, to increase in size. If it is located within the lesser pelvis, an incarceration of the mass may occur, which tends to produce a benign form of degeneration under which complete disappearance may result. On the other hand, the myoma may be displaced upward with the enlargement of the uterus, a fact which the physician should turn to account by a careful examination from time to time. This displacement may occur very late in pregnancy, after the operation of Cæsarean section had been decided upon. Exceptionally the presence of these growths may set up peritonitis, thereby adding to the difficulties already present. As a rule, the presence of myoma uteri interferes little with the course of gestation. Again, if the tumors affect the cervix rather than the body of the uterus, mechanical disturbances of several kinds may occur, and it is this form which tends to produce the higher grades of obstructive dystocia. Although, as already stated, tumors in the bony pelvis often ascend and cease to obstruct labor, even after the latter is under way, this mobility appears to be made possible by a softening which they sometimes undergo during gestation. After delivery these tumors tend to diminish in size, corresponding to the increase noted after conception. They may undergo a process of complete involution, running parallel with that of the uterus itself. The presence of myomata during the third stage of labor interferes with the detachment and expulsion of the placenta, thereby favoring the occurrence of post-partum hemorrhage. Uterine myomata may undergo suppuration during the puerperal period, becoming foci of local sepsis.

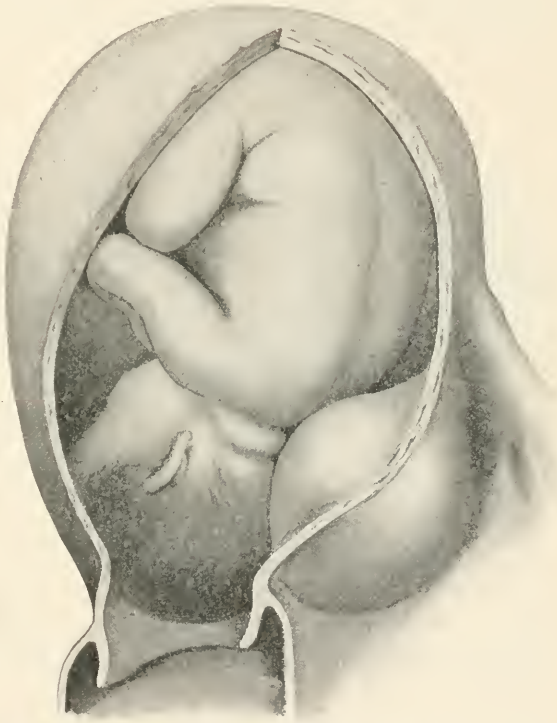

FIG. 801.—MYOMA OF THE LOWER SEGMENT AND CERVIX.

Diagnosis.—The condition may lead to several difficulties of diagnosis. Thus, the metrorrhagia from the presence of the tumor masks the amenorrhea of gestation; the enlargement of the uterus occurs as the result of either condition. As pregnancy advances the tumor may soften to a remarkable degree and thus be overlooked; if a diagnosis of myoma has already been suggested, this seeming disappearance may lead to a change of opinion.

Prognosis.—This depends entirely upon the size and seat of the tumor. Small subserous or interstitial tumors may be ignored in prognosis and treat-

ment. Others may or may not require extirpation during pregnancy. As a rule, gestation itself is undisturbed by the presence of the growths. Labor and the puerperium may not be interfered with.

Treatment.—During pregnancy the management is as follows: If the size and seat of the tumor occasion apprehension for the welfare of the mother and child, it is better to perform myomectomy, than to interrupt pregnancy, for this interruption destroys the child, is dangerous to the mother, and is without effect upon the tumor. The danger of accidentally inducing abortion through the operation of myomectomy is slight. If this operation is impracticable, supra-vaginal amputation of the pregnant uterus should be performed. Growths which are dangerous chiefly from their position in the lesser pelvis should be watched carefully in the hope that they may ascend. We should even refuse to interfere at term, since this ascent often occurs after labor has begun. Then, if ascent has not occurred spontaneously, the patient should be anesthetized and placed in the lateral, abdominal, or knee-elbow position, when it will often be possible to press the mass into the abdominal cavity, even when it appears to be incarcerated in the pelvis. If the tumor is irreducible, it is better to perform Cæsarean section, even if the child is dead, because of the great difficulty in perforating and extracting in the presence of the growth in the pelvis.

FIG. 802.—MYOMA OF THE CERVIX WHICH HAS BEEN PUSHED DOWN INTO THE VAGINA BY THE ADVANCING HEAD. FACE PRESENTATION LEFT MENTO-ANTERIOR.

Ovarian Tumors.—The presence of these neoplasms in the abdominal cavity adds to the pressure symptoms caused by the pregnant uterus, and during labor interferes with the force of the uterine contractions. In cases in which they remain in the pelvis they may cause either partial or complete obstruction of the birth tract. *Diagnosis:* The under surface of the tumor may be made out by the vaginal touch. If fluctuation cannot be recognized, an exploratory puncture may be made. As a rule, the cervix is placed very high, and the presenting part of the child does not descend. *Course and Prognosis:* The complication of ovarian tumor with pregnancy is always serious. The cyst is liable to rupture, which event might be regarded as desirable except for the danger of peritonitis, hemorrhage, and gangrene of the cyst. *Treatment:* Such cases should never be left to Nature. If the tumor is recognized during pregnancy, it must be extirpated unless very small. The same course is advised even during labor, whenever practicable. Thus, in a typical case the indication would be to perform laparotomy, extirpate the growth, and terminate the labor by Cæsarean section. This course cannot be pursued as a matter of routine, and in the majority of cases the operator has to be content with the attempt to push the tumor from the pelvis into the abdominal cavity. He must be

prepared in these cases for the accidental rupture of the cyst; and if the attempts at reposition fail, he should seek to diminish the size of the mass by tapping. If this resource also fails, and if the exigency of the case forbids extirpation of the growth, Cæsarean section alone must be performed.

Miscellaneous New Formations.—Other benign tumors which may cause maternal dystocia are of rare occurrence. They comprise dermoids of the pelvic connective tissue; echinococci in the same location and also in the peritoneal cavity; floating kidney and spleen, etc. As a rule, the various cystic formations should be treated like ovarian tumors. Displaced organs should be replaced before delivery, or if they complicate labor they should be thrust out of the way. Hernias—umbilical, inguinal, femoral—may form an obstacle to labor by interfering with the proper force of intra-abdominal pressure. They should be reduced or held in position until after the delivery has been effected, when, if necessary, they may receive attention.

XI. ANOMALIES OF THE MEMBRANES.

The dystocic element in force here is connected principally with the period of rupture, and hence we may consider the entire subject under the following classification: (1) Dystocia from premature rupture; (2) dystocia from tardy rupture; (3) dystocia from adherent membranes.

1. Premature Rupture.—Premature rupture is not necessarily due to any intrinsic peculiarity of the membranes, but to anomalous conditions elsewhere; *i. e.*, contracted pelvis, or shoulder presentation. A certain proportion is thought to be of endometritic origin. Early rupture of the membranes is of frequent occurrence, but the condition is not invariably dystocic because the amniotic fluid does not necessarily all escape. When such is the case, however, the dystocic condition known as "dry labor" develops. (Page 570.) The loss of the water wedge before the completion of dilatation brings the head of the fetus in direct contact with the cervix; this tends to induce a tetanic action of the uterus and work injury to the cervix. The latter becomes greatly elongated and its anterior lip often œdematous; laceration is very common. Compression of the fetal head causes a tendency to asphyxia and intracranial hemorrhage. The tetanic action of the uterus combined with the œdematous cervix retards the first stage of labor and exhausts the mother. Premature rupture is greatly dreaded in anomalous presentations and contracted pelves, conditions under which it is especially prone to occur. In such cases it contributes a further element of dystocia. The form of irregular uterine action caused by dry birth is described under anomalies of the expulsive forces (page 570); the injuries of the cervix are given on page 592, and the treatment comes under the head of protracted first stage. (Page 572.)

2. Tardy Rupture.—Dystocia connected with tardy rupture of membranes originates in anomalies of the membranes themselves, such as increased density or elasticity. After full dilatation there is no tendency to spontaneous rupture, engagement goes on, and rupture may occur in the vagina or the fetus may be born with its membranes intact ("born with a caul") (Fig. 1009). Dystocia in these cases comes from the additional work thrown upon the uterus by having to expel the unyielding amniotic fluid along with the fetus. This condition is remedied by simply puncturing the membranes as soon as dilatation is complete.

3. Adhesions.—Another form of dystocia of membranous origin is due to

adhesions between the membranes and the lower segment of the uterus. The cause is endometritis. When labor begins, the cervix fails to dilate and the condition may be confounded with agglutination, inertia, rigid os, etc. The cervix is pervious to the finger and the adhesions may be plainly felt. Although the uterine body may be contracting readily, the cervix remains passive. After a variable period the chorion gives way and dilatation begins with the amnion as the sole membrane of the bag of waters. In some cases the chorion does not give way of itself; it must then be detached by sweeping the finger around the inner os. (Page 573.) If this attempt fails, it is justifiable to puncture the bag of waters even if dilatation has not occurred, as the os will then dilate.

XII. RIGIDITY OF THE INTERNAL AND EXTERNAL OS. TRISMUS UTERI.

Numerous states of the cervix may be responsible for its failure to dilate during the first stage of labor. The various conditions which determine dystocia of cervical origin should be considered together, even at the risk of repetition, especially in regard to differential diagnosis, although some of them are not entitled to the designation of rigid os or cervix. The causes of cervical dystocia may be divided into (1) functional, (2) organic.

1. Functional or Spastic Rigidity. Trismus Uteri.—Dystocia of functional origin is due principally to a *spastic rigidity of the external os;* much more rarely, and usually in premature births, we observe a corresponding condition in the internal os, more pronounced in induced than in spontaneous delivery. The extreme type of spastic rigidity is known as "trismus uteri." Dystocia of functional character is very common, its frequency being due to the great variety of conditions under which it occurs. *Etiology:* The most pronounced type is the reflex. Some conditions on which this depends are (1) the immediate pressure of the fetal head on the cervix in premature rupture of the membranes with evacuation of the amniotic fluid; (2) the presence of a malposition of the fetus with failure of the presenting part to adapt itself to the cervix, the membranes having prematurely ruptured; (3) pre-existent inflammatory conditions of the lower segment; (4) ill-advised attempts at operative interference; (5) any condition of the upper segment which can induce painful contractions; (6) distended bladder and rectum. *Spasm of the internal os* is a condition evidently little understood. Recent experience has taught me that functional rigidity is often present at the internal os in late abortions and premature labors. Often both internal and external rings, as well as the lower part of the uterus are involved. In addition to essential functional rigidity, it is highly probable that in the organic forms about to be described more or less functional spasm coexists. A species of rigidity which appears to be *sui generis* is that which occurs in elderly primiparæ. It has been termed "organic," "functional," and both combined. It has been proposed to distinguish this form by the names "constitutional" or "anatomical."

2. Organic Rigidity.—The numerous conditions which have been comprised under this head are divisible into two classes, (1) congenital and (2) acquired. (1) *Congenital:* Complete imperforation would prevent all chance of conception. Congenital elongation of the portio is practically the only known congenital malformation of the os from the standpoint of cervical dystocia. This condition has been known to delay the first stage of labor and to require mechanical dilatation. (2) *Acquired:* These may be divided into four classes: (1) Conditions which alter the consistency of the cervix; (2) conditions which efface the os; (3) deviations of

the cervix; and (4) adhesions between the cervix and membranes. The three last named have all been described elsewhere (pages 603, 608, 605). There remains for consideration acquired organic rigidity in the narrower sense of the term. Of this there are six varieties: (1) Traumatic or cicatricial. These are caused by operation or the use of the cautery. Authorities differ as to the ability of the ordinary tears of childbirth to produce this condition. Sloughing of the cervix should be followed by changes of this character. The parts are the seat of more or less scar tissue, while the cervical canal may contain bridles of the same. (2) The hypertrophic conical elongation of the cervix as seen in prolapse of the genitals. Such a cervix dilates slowly, but there is no further abnormality. (3) Inflammatory. More or less rigidity may result from cervical endometritis and metritis if severe or protracted. (4) Specific. Tarnier devotes considerable attention to syphilitic rigidity of the cervix which may occur in a variety of forms—the induration of a primary sore, the sclerosis which follows upon the unnatural development of the mucous patches in connection with that of the pregnant uterus; gummata; tertiary ulcers; cicatrization, and, finally, a peculiar type of sclerosis comparable to syphilitic stricture of the rectum in which, as is well known, the lesions are non-specific, although the cause is clearly syphilitic (parasyphilitic sclerosis). (5) Neoplastic. Benign tumors of the cervix have been considered elsewhere. (6) Malignant. (See Cancer of the Uterus, page 610.)

The symptoms, diagnosis, and management of the foregoing may be considered in common.

Symptoms.—The os dilates slightly or not at all, so that labor cannot advance. If dilatation is possible, the process is very slow. The condition becomes one of obstructed labor in the first stage and the subject is treated under that head (page 570). Individual symptoms will be mentioned under diagnosis.

Diagnosis.—Spasmodic rigidity theoretically should readily be distinguished from any other form, but as a matter of fact spasm may be associated with organic rigidity, so that the presence of the latter is not excluded. Some authorities recognize the presence of spasm in slow dilatation, by the absence of tension in the bag of waters and of the normal mucus of the cervix (Galabin), by its tenderness and heat, and by the hard, thin, unyielding edge of the cervix (Tarnier). When a physician is confronted by non-dilatation, he should exclude all possibility of such conditions as deviation and occlusion and of adhesions between cervix and membranes. He then has to distinguish between (1) functional, and (2) organic rigidity. Owing to differences in the conception of these conditions by different authorities, it is hardly possible to lay down rules for diagnosis which will be in harmony with the teachings of all. I believe it is of vital importance to distinguish between mere slowness of dilatation and organic rigidity, etc.; in other words, between cases for intervention and for non-intervention.

Treatment.—*Spastic rigidity:* The tendency of this condition is gradually to disappear; dilatation being finally established. Serious accidents are rare. A certain amount of expectancy is indicated in conjunction with antispasmodics, including warm vaginal irrigations, chloral or opiates by the rectum, and, if the preceding fail, the inhalation of chloroform. Finally, if everything has failed, spasmodic ridigity must be treated like other forms by hydrostatic manual or instrumental dilatation and multiple incisions. The preceding summary of treatment does not include any causal indications; it is, of course, understood that causal elements, if amenable to removal, will be so dealt with before other treatment is instituted. If the causes cannot be reached, the symptom must be treated directly as above. *Congenital organic rigidity:* After a due interval of

expectancy, say four or five hours, artificial dilatation should be begun with the finger or instrumental dilators and finished with the use of the hydrostatic bag or by bimanual dilatation. (See Operations, Part X.) *Acquired organic rigidity.* There is a likelihood that all these forms of organic rigidity will be accompanied by a certain amount of functional spasm, hence some good might be accomplished by applying the treatment already indicated for spastic rigidity while awaiting dilatation. When intervention is proved to be necessary, dilatation should be attempted; and if this fails, incisions are indicated. (See Operations, Part X.)

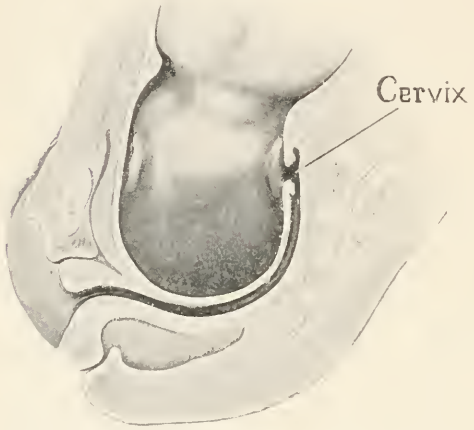

FIG. 803.—BACKWARD DEVIATION OR MALPOSITION OF THE OS. Sacciform dilatation of the anterior portion of the lower uterine segment. Of frequent occurrence.

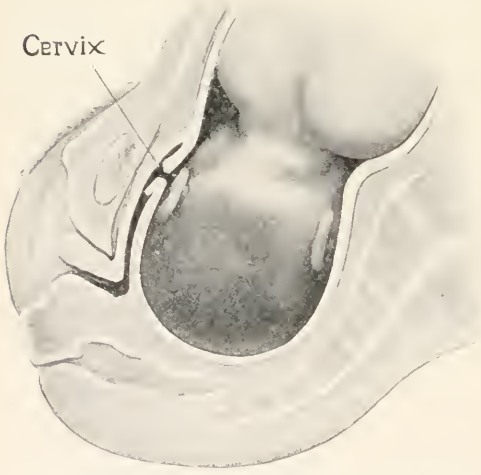

FIG. 804.—ANTERIOR DEVIATION OR MALPOSITION OF THE OS. A RARE ANOMALY.

XIII. DEVIATION OR MALPOSITION OF THE CERVIX.

In this condition the cervix may occupy either the anterior or posterior fornix or may be displaced laterally after the same fashion (Figs. 803 and 804). **Etiology:** The common but not sole cause of this condition is obliquity of the entire uterus. The same effect is produced, however, by overdevelopment of some portion of the inferior segment during the latter part of pregnancy. These may both coexist in the same uterus. Backward deviation is the more frequent clinical variety (Fig. 803). It is due either to anteversion or to overdevelopment of the anterior portion of the lower segment.* This form of deviation is very common (Fig. 803). Anterior and lateral deviations are produced in a similar manner, but are of much more rare occurrence (Fig. 804). **Symptoms:** As in all dystocic anomalies of the cervix, most of our information is obtained from touch, confirmed in certain cases by the result of palpation of the uterus through the abdominal wall. The vaginal touch, which should always take account of the culs-de-sac, finds one effaced and the other of undue depth. In backward deviation the fetal head is often found engaged and almost upon the pelvic floor. The cervix looks directly backward upon the sacrum, at a height which varies in individual cases, and which may attain the promontory.

* Sacciform dilatation of the anterior portion of the lower uterine segment.

It may be difficult in the latter case to feel the os at all (Fig. 803). In anterior deviation the conditions are reversed. The os looks toward the upper part of the symphysis, and it may be impossible to reach it with the finger, unless the patient is first placed in the genupectoral position. (See Posture, Part X.) Analogous symptoms are present in lateral deviation. **Diagnosis:** If the practitioner cannot locate the os, he may conclude erroneously that he is dealing with imperforation of the cervix, or that the latter has become completely effaced by dilatation. It has happened that the inexperienced have sought to apply forceps under the latter misapprehension. In order to make a differential diagnosis it is sometimes justifiable to rupture the membranes. I urge that the patient be chloroformed and a manual exploration made. **Prognosis:** Generally deviations give an unfavorable prognosis, which varies with the degree of the complication. In the milder cases spontaneous restitution may occur as labor advances. In the more severe types all the phenomena of obstructed labor may be developed. **Treatment:** After a period of waiting for nature to correct the deviation, an attempt should be made to tilt the cervix into its proper axis by the finger in the vagina and hooked into the os, choosing the time when a pain is present. If this succeeds, the position of the cervix should be tested during subsequent pains. If it fails, as is frequently the case in anterior deviation, it may be necessary to open the os mechanically and to extract the child, alive or dead.

XIV. OCCLUSION OF THE EXTERNAL OS.

This condition—also known as conglutination, agglutination, or obliteration of the external os—can occur only after impregnation has taken place. However, there is probably an incomplete degree of this condition which might permit the entrance of spermatozoids into the uterus. **Etiology:** Occlusion of the os comprises several types. In the simplest form the os is agglutinated with inspissated mucus. A more complex variety represents obliteration from fibrous adhesions. The actual cause of occlusion, or at least of the type of fibrous adhesion, is traumatism, the healing of old lacerations, the results of cauterization or inflammation. A predisposition may be present, such as congenital narrowing of the cervix. Occlusion occurs more frequently in multigravidæ. **Symptoms and Diagnosis:** There are hardly any symptoms in the ordinary sense of the word. The imperforate condition is recognized at the onset of labor, and has then been mistaken for complete dilatation. The closed os is sometimes recognized and located by the presence of a slight prominence or depression. A valuable symptom is the dryness of the vagina from the absence of cervical secretion. Diagnosis can be made only after rigidly excluding other dystocic anomalies of the cervix. It is often impossible to distinguish between the two principal forms of obliteration. **Prognosis:** The os may open spontaneously, especially in the mucus agglutination; otherwise we may look forward to the various phenomena of obstructed labor. **Treatment:** The closed os must be reopened, if possible, by the finger, using the nail. This is easy with mucus agglutination or incomplete fibrous occlusion. In two cases of complete occlusion I have reopened the os with blunt scissors during labor. In one case it was necessary to dilate the opening manually. In the higher degrees of the fibrous type it may be necessary to perform vaginal Cæsarean section. (See Operations, Part X.) In intermediate grades it may suffice to incise the site of the os in different directions with the scissors or bistoury and to apply the forceps.

XV. CANCER OF THE UTERUS.

As a general rule, if a woman with uterine cancer becomes pregnant, the disease is aggravated. In some 15 per cent. of cases the pregnancies are interrupted, and in the remainder at least a third of the children are still-born even at term, the proportion being much larger in premature delivery. Prolonged pregnancy is not uncommon in women with uterine cancer. Spontaneous delivery is possible when much of the cervix remains intact, and even when it is largely replaced by cancerous tissue, provided the latter is yielding. The softening of the affected tissue, however pernicious in itself, may enable the uterus to expel its contents. If the fetus cannot pass the obstruction a delayed labor results, and cases are on record in which the women thus afflicted have been in labor for over a week. Under these circumstances maternal death from exhaustion, or death and putrefaction of the fetus, or general maternal septicemia may occur. Another possibility is rupture of the uterus. If delivery results without the occurrence of these accidents, the patient is doomed to pass into the cancerous cachexia. The recognition of cancer of the uterus should not be difficult. If some doubt exists, a piece of the cervix should be excised and examined microscopically. The presence of cancer sometimes obscures the diagnosis of early pregnancy. **Treatment**: If the patient is seen during the course of the pregnancy, an attempt may be made to let the case go on to term, and treat the woman with anodynes, hemostatics, tonics, etc. Such a course should be elected only at the request of the patient and under peculiar circumstances, such as the desire for an heir. To extend this line of treatment it would also be rational to perform a palliative operation upon the cancer. In the majority of cases the natural course to pursue would be to interrupt the pregnancy after the child becomes viable, or to perform a Cæsarean or Porro-Cæsarean operation, or hysterectomy. Therapeutic abortion is strictly contraindicated in these cases. (See Part X.) These radical measures, however, are not always indicated or applicable, and if the obstetrician finds himself in the presence of a case of labor in a woman with uterine cancer, when the immediate indication is to oppose the rigidity of the os, the proper course to pursue is mechanical dilatation or incision, the latter being full of danger to the patient. As these measures may be insufficient, it is permitted to perform a rapid ablation of the cancerous cervix and to deliver the child with the aid of the forceps or version; or in case of death of the fetus, some form of embryotomy is the indication. Cæsarean section alone is the indication of necessity when the cancer has extended from the uterus to the vagina or has become inoperable. A total hysterectomy should be performed when the cancer is technically operable.

XVI. RIGIDITY AND ATRESIA OF VAGINA AND VULVA.

Obstruction to labor arising within the vagina may be either (1) functional or (2) structural. The former consists in the spasmodic condition known as vaginismus.

1. **Vaginismus.**—Vaginismus is almost peculiar to first labors. If it is of high degree, the first indication is to resort to chloroform narcosis. If by this means the spasm is not overcome, then manual dilatation or deep incision should be practised, with subsequent application of the forceps in obstinate cases. The spasmodic condition of the pelvic floor may attain such a high degree that delivery of a living child is impossible.

2. There are a number of **structural alterations** of the vagina which cause dystocia. They may be divided into (1) congenital and (2) acquired.

(1) CONGENITAL AFFECTIONS comprise (*a*) simple narrowness or smallness of the passage, (*b*) atresia, (*c*) septa, and (*d*) abnormal terminations. (*a*) *Small vagina:* This is not described by most authors. In Tarnier and Budin's great work* considerable space is given to it. Every gynecologist and obstetrician knows that some vaginæ are unnaturally small, and while the pregnant state softens the tissue and makes it more distensible, such vaginæ have a special tendency to laceration during labor. (*b*) *Atresia* (Fig. 805): This term should be used to denote congenital imperforation which may be complete or partial. It is of rare occurrence in comparison with cicatricial stricture—a condition which it resembles. It exhibits every variation in regard to the length of the constricted portion and the degree of imperforation. From the standpoint of dystocia, atresia and cicatricial stricture may be considered together (see the latter). (*c*) *Septa:* The vagina may be divided into compartments by septa, longitudinal and transverse. Longitudinal septa represent the abortive vagina duplex. They form large "bridles" between the anterior and posterior walls and almost inevitably obstruct labor and bring about their own rupture. The fetus has sometimes been strangled by one of these "bridles" getting about its neck. Transverse septa may be multiple. They should not be confounded with atresia in which the narrowed area has length as well as breadth, for the transverse septa are mere diaphragms containing openings of various sizes. The opening in one of these high up in the vagina may be taken for a partially open os. Such a mistake could hardly occur if the physician always feels for the culs-de-sac. Transverse septa offer more or less resistance to labor. For convenience of description the septa will be considered in their dystocic aspects with atresia and cicatricial stenosis. *Abnormal terminations:* In the absence of external genitals the vagina has been known to empty into the urethra or rectum. Impregnation has actually occurred in both abnormal openings. Children have been born through the anus, and have even been delivered through the latter with forceps.†

FIG. 805.—ATRESIA OF THE VAGINA.

(2) ACQUIRED AFFECTIONS may be grouped under the title cicatricial stricture, a term which fits them and which agrees with the nomenclature of other organs of tubular structure (rectum, esophagus). It is a mistake to use the word atresia in this connection. *Cicatricial stricture of the vagina:* This is due either to the results of traumatism or to local infection. In either case loss of substance occurs by sloughing, ulceration, or healing by second intention. The resulting scar produces a constriction in some portion of the organ. The commonest source of traumatic stricture is child-birth, which may operate in several ways; thus, impaction of the fetal head in the vagina may end in sloughing, so that a vesico-vaginal or recto-vaginal fistula may develop with the stricture. Again, extensive laceration of the vagina, such as results from improper use of the forceps, may lead to similar results. Stricture is also due to infective disease.

* Paris, 1900.

† Tarnier and Budin, Edition 1900, Paris.

General Consideration of Vaginal Atresia, Transverse Septa, and Cicatricial Stricture.—These three conditions—the two former congenital, the last acquired—represent collectively the atresia of text-books, and as far as obstetrical practice is concerned they may be considered together. Such a study has been made by Maher,* who found records of over 200 labors with such complications. He found the most common form to be a thin transverse septum situated midway in the vagina, having openings of varying sizes. In one-half of all the cases the obstruction was in the middle of the vagina, while the remainder were divided equally between the upper and lower thirds. The obstructions may exhibit very different behavior during labor according to their size and consistency. They may stretch and allow the fetus to pass, may lacerate, or oppose such resistance to the passage of the fetus that something above the obstruction yields. Thus, ruptures of the uterus and of the recto-vaginal walls have occurred under these circumstances. The mortality in labor with vaginal obstruction is high for the child and considerable for the mother; Maher's figures are 41 and 13 per cent. respectively (Fig. 805).

Treatment.—In the majority of cases spontaneous delivery is possible. Each case must be managed in accordance with the character of the obstruction. Attempts at dilatation will probably induce labor, hence they should not be employed before term unless premature delivery is desired. The use of hydrostatic bags, digital dilatation, and shallow radiating incisions is justifiable to assist nature. Dilatation must be complete before the forceps is applied. After delivery the constricted point should not be allowed to close again; daily irrigation and dilatation should be practised. When the obstruction is unyielding or when vesico-vaginal fistula coexists, Cæsarean section is indicated; but if the obstruction is such that the lochia could not escape by the vagina, the Porro operation is to be preferred.

Rigidity of the Vulva; Persistent Hymen.—The vulva may exhibit a narrowness or rigidity as a whole which is either overcome in time by the act of labor or leads to multiple lacerations. Unnatural rigidity of the perineum is considered under the head of the management of this structure during labor. (Page 480.) Aside from the vulva proper, resistance may be encountered from the hymen, naturally in primiparæ and only when some anomaly of formation is present. As a rule, the various types of persistent hymen give way under the pressure of the child's head, but exceptions occur in which labor has actually been obstructed by this structure, such a state of affairs having been confounded with vaginismus. Such resistance has been offered in these cases that a central laceration of the perineum has occurred through which the child was born. The treatment of resistant hymen is simple, consisting in gradual digital dilatation or in multiple incisions.

Obstructed Labor due to the Levator Ani.—(1) Occasionally instances occur in which a well-flexed head rotates at the pelvic floor, bringing the sagittal suture into the antero-posterior diameter of the outlet. Then, in spite of strong uterine contractions and an elastic pelvic floor, no advance occurs. In these cases the contraction of the levator ani simultaneously with the abdominal muscles (voluntary forces) offers just enough resistance to hold back the head. Moderate traction of a few pounds with the forceps will be sufficient to exhaust and overdistend the fibers of the muscle and overcome the obstruction. (2) There are certain cases in which dangerous obstruction occurs in cases of permanent hypertrophy and shortening of the levator sufficient to necessitate craniotomy.

* "Virginia Medical Semi-monthly," 1897, II, 176.

XVII. VAGINAL AND VULVAL THROMBOSIS. HEMATOMA AND OEDEMA.

The conditions known as puerperal **hematoma** and **thrombosis** are occasionally present before the birth of the child, and under these circumstances if sufficiently large, may constitute an obstruction to the presenting part (Fig. 807). This accident has a special significance in twin pregnancies, for while it may not occur sufficiently early to obstruct the first child, it may interfere with the birth of the second. *Treatment:* If the birth of the child is actually obstructed or if rupture of the tumor is threatened, the usual practice is to perform incision and extract the child as soon as possible, after which hemostasis is indicated. (See Puerperal Hemorrhages.) **Œdema** of the vulva and vagina may precede labor, in which case it is due to renal or cardiac disease; or it may be the result of labor itself in conditions of impaction of the head in the vagina. (Fig. 467.) The œdematous tissues are very vulnerable and prone to gangrene. The indication would ordinarily be incision, but the liability to septic accidents is a contraindication save when intervention is absolutely necessary. When a rupture at the vulval outlet is threatened, episiotomy may be performed under strict asepsis.

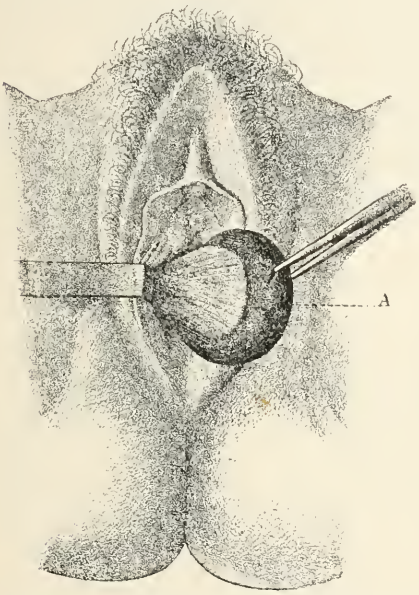

Fig. 806.—Pedunculated Superficial Thrombus of the Vagina. *A*, Tumor drawn to left.

Fig. 807.—Fibroid Tumor of the Right Labium Majus Resembling a Thrombus.

XVIII. DISTENDED BLADDER AND RECTUM. CYSTOCELE, RECTOCELE, VESICAL CALCULUS.

Distended Bladder.—The subject of retention during pregnancy is considered on page 318. The condition is often encountered during labor, because the presenting part may, during its descent, press upon the neck of the bladder. As the cervix dilates, the summit of the bladder ascends into the abdomen. Abdominal palpation will therefore readily reveal the presence of the fluctuating mass in front of the uterus. The urine collects in the upper part of the bladder

and impairs the efficacy of uterine contractions. An elastic male catheter will probably be required to reach the urine. Owing to the displacement of the meatus and urethra, considerable difficulty may be encountered in entering

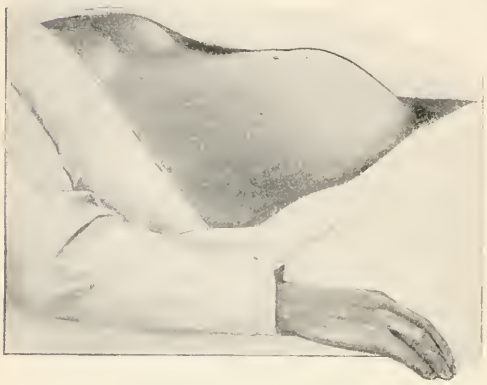

FIG. 808.—DISTENDED BLADDER DURING LABOR.

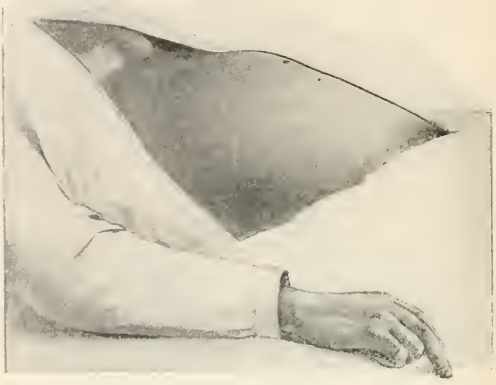

FIG. 809.—ABDOMEN SEEN IN FIG. 808, AFTER THE USE OF THE CATHETER.

the bladder. It may even be necessary to push back the advancing head in order to make way for the passage of the instrument (Figs. 808 and 809).

Fecal Accumulations.—The extreme type of retention of feces known as coprostasis, in which ordinary resources are insufficient for the evacuation of the bowel, constitutes a serious mechanical obstacle to delivery and may lead to grave consequences (Fig. 810). Such a condition is of very rare occurrence, for Tarnier* saw but one case. One would expect coprostasis to depend, in these cases, upon some malformation of the rectum, and such a coincidence is known to have occurred. These fecal accumulations obstructing a portion of the pelvic cavity must have the same dystocic effect upon labor as a contracted pelvis; they prevent engagement of the head and lead to faulty positions. Owing to the degree of hardness of the feces, removal can hardly be effected save by extracting them piecemeal with the finger or a scoop.

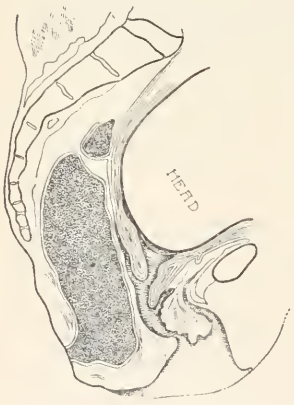

FIG. 810.—DISTENDED RECTUM OBSTRUCTING LABOR. —(*From W. C. Lusk's frozen section.*)

Cystocele.—A large cystocele which produces inversion of the vagina necessarily causes a variety of stenosis of that portion of the birth tract. Such a condition may be due to vesical calculus (page 615). An ordinary cystocele may be remedied for the time being by evacuating the bladder with a catheter so bent as to reach the interior of the pouch. In cases of obstructed labor the prolonged compression of the vagina against the symphysis may result in necrosis and fistula.

Rectocele.—This condition, due to prolapse of the vaginal wall, is very rarely encountered during labor. When present, the tumor may contain either the rectum or a portion of the intestines (vaginal enterocele). The diagnosis is

* Tarnier and Budin, vol. III, p. 488.

made by digital exploration of the rectum. Rectocele is not a formidable complication of labor and the danger of impaction and pressure accidents is not great. An enema should be given, after which the prolapsed vaginal wall should be replaced until the presenting part has passed the obstruction. (For consideration of enterocele, see page 614.)

Vesical Calculus.—Stone in the bladder very rarely complicates pregnancy. Cases have, however, been recorded in which calculi have obstructed labor either by causing vaginal cystocele or through impaction at the pubis. In any case of obstruction of the vagina the possibility of calculus should be excluded by passing a vesical sound. The stone must be removed from the region of the birth tract by placing the woman in the modified latero-prone or knee-elbow position. (See Part X.) If this is impossible, vaginal lithotomy must be performed; the wound cannot be closed, however, until after delivery. If a small calculus could become impacted in such a way as to impede labor, it should be possible to extract it through the urethra after previous dilatation.

XIX. FRACTURES OF THE PELVIS.

In a pelvis which is greatly contracted the innominate bones may sometimes be fractured by instrumental delivery. This is inexcusable, for with such a pelvis forcible instrumental delivery is contraindicated, a safer treatment being some major operative procedure. On the other hand, rachitis or some other pathological process may render the bone so fragile that it will break during an instrumental delivery through no fault of the obstetrician. In certain cases, especially of elderly primiparæ, the coccyx is broken by the passage of the fetal head. The condition of coccygodynia follows. This is most painful, and often demands subsequent removal of the broken piece (Figs. 852, 853, 854).

XX. DIASTASIS OF THE PELVIC JOINTS.

Etiology: This condition is the result of the natural traumatism of labor and may affect the symphysis or one of the sacro-iliac joints. All three of the interpelvic articulations may be involved at the same time. A general predisposition to this is furnished by the relaxation which the pelvic joints undergo during pregnancy. Multiparæ are predisposed by reason of relaxation from repeated pregnancies. Pelvic deformity constitutes a strong predisposition; so do unusual size of the fetus, disease of the joints, etc. A special class of cases is due to the use of the forceps. In some cases the mechanism of the injury is obscure, none of the preceding factors having aided in its production. This accident occurs with considerable frequency, especially in osteomalacic, generally contracted, and funnel-shaped pelves. The joint most frequently ruptured is the symphysis. **Symptoms:** Unless the patient happens to be under the influence of an anesthetic, she usually feels "something give way" at the time of the accident. The limbs are seen to be rotated outward and are immovable. Pain, both spontaneous and induced, is usually present over the affected joint. When the symphysis ruptures, the vagina is usually lacerated, and the finger can recognize the injury by palpation. The **prognosis** is good as a rule. The **treatment** of ruptured symphysis corresponds to the after-treatment of symphyseotomy. The pelvis should be immobilized by strips of adhesive plaster or plaster-of-Paris and the patient should remain in bed four or five weeks before attempting to walk.

XXI. PELVIC DEFORMITY.

Definition.—A deviation in size, shape, or mobility from the normal type, sufficient to cause unfavorable symptoms during pregnancy and labor. The larger part of these abnormal forms are contractions full of danger for both mother and child, and often demand instrumental delivery. The deformity may exist in any one or all of the diameters, the most frequent and most serious being those which affect the pelvic inlet. Besides mechanical obstruction in pelvic deformity, the physician often has to deal with unfavorable mechanisms of labor caused by abnormal posture, position, or presentation.

Frequency.—The frequency of pelvic contraction in native-born American women has been estimated at 2 per cent., and among foreign-born women at 6 per cent.* It is, however, probable that its frequency in American women, especially among the poorer classes and in the large cities, has been underestimated. According to Winckel, pelvic contraction occurs in from 10 to 15 per cent. of women, but it is sufficiently marked to cause symptoms in only 5 per cent. Contracted pelves are believed to be rarer in America than abroad. However, Williams states that they are nearly as common in Baltimore as on the continent of Europe. He found that from 12 to 15 per cent. of women show them, but most of these were not marked enough to impede labor. Reliable statistics, however, are generally wanting; and it must happen that the lesser degrees of pelvic deformity pass unnoticed, particularly when no systematic measurements are made, and when the attention of the accoucheur is directed to the measurements of the various pelvic deformities only by some actual obstruction to the passage of the child. It has been only in recent years that the subject of pelvimetry has been given the place it deserves in conservative obstetrics. The regular and routine adoption of the examination of pregnancy (see page 148), including pelvimetry, will prove to any one the frequency of contracted pelves. Then, and only then, will the real cause of many anomalies in labor be apparent, such as malpresentations and malpositions, prolonged labor and uterine inertia; and the premature induction of labor, the use of the forceps, of version, symphyseotomy, and cranioclast will not be empirical, but will be employed for a rational and sufficient cause. In the last ten years the statement has frequently been made to the author by graduates attending his lectures and clinics, that in several years' practice they have never observed a single case of deformed pelvis, but their ratio of difficult forceps, versions, perforations, and even vesico-vaginal fistulæ was fully up to the average.

My conclusions from a critical study of 1200 consecutive hospital cases are as follows †: (1) Of 1200 consecutive cases measured, 499, or 41.58 per cent., were American-born women; 215, or 17.91 per cent., Irish; 130, or 10.83 per cent., Russian; 105, or 8.75 per cent., German; 30, or 2.50 per cent., black, etc. (2) Contracted pelves occurred in 44 cases, once in 27.27 cases, or in 3.66 per cent. Generally contracted pelves occurred in 30 cases, once in 40 cases, or 2.50 per cent. Flattened pelves occurred in 14 cases, once in 85.71 cases, or 1.16 per cent. No irregular forms of contraction were observed. (3) Twenty, or 45.45 per cent., of my cases of pelvic contraction were among American-born women, and deformity occurred once in 24.95 of these cases, or in 4 per cent. (4) Three, or 6.81 per cent., of the contracted pelves were among black women, and deformity occurred once in 10 of these cases, or in 10 per cent. (5) My material gives a frequency of contracted pelves (1200 cases, 3.66 per

* "Trans. Amer. Gyn. Soc.," 1890

† "Pelvic Deformity in New York City," "Trans. Amer. Gyn. Soc.," 1902.

cent.) midway between the conclusions of Williams (Baltimore, 1000 cases, 13.1 per cent.); Crossen (St. Louis, 800 cases, 7 per cent.); Reynolds (Boston, 2127 cases, 1.13 per cent.); and Flint (New York, 10,223 cases, 1.42 per cent.). (6) My statistics—3.66 per cent. of contractions in 1200 cases—differ from those of England (F. Barnes,* of London, 38,065 cases, 0.5 per cent.); of France, 5 to 21.11 per cent.†; Germany,‡ 9 to 9 per cent.; Switzerland, 8 to 16 per cent.; Austria-Hungary,§ 2.44 to 7.8 per cent.; Russia,‖ 1.2 to 5.1 per cent.; Italy,** 18.13 per cent.; Holland,†† 3.51 per cent. (7) Special or irregular forms of pelvic contraction, such as osteomalacia, obliquely contracted, coxalgic, double coxalgic, spondylolisthetic and kyphotic, or fractured pelvis, are uncommon in this country. (8) The generally contracted pelvis is the deformity most frequently met with in New York. I found twice as many generally contracted as flattened pelves in my material (30.14). Williams found practically the same condition in Baltimore (79.45). (9) Records kept of private and consultation cases in New York over a period of ten years show a somewhat higher percentage than the results obtained from the 1200 hospital cases—namely, about 5 per cent. for all deformities, the generally contracted pelvis being twice as frequent as the flattened. The frequency seems to vary in different countries. The Saxon pelves are most often contracted, which explains why Zweifel has performed ninety Cæsarean sections. They are common enough to explain why the second stage often lasts four or five hours, why face presentations and other anomalies are numerous. Deformed pelves are frequent enough anywhere to demand that the physician be familiar with the different varieties, and also that he be versed in the art of pelvimetry. Schauta's estimate is twenty per cent. in Austria. There are numerous geographical variations which do not yet admit of a definite explanation. Among the native American women today the rachitic pelvis is very infrequent, the most common types being the generally contracted and those following spinal deformity.

General Etiology and Development.—The etiological factors which may be considered as producing deformed pelves are: (1) Defective development; (2) disease of the pelvic bones; (3) irregularities in the junction of the pelvic bones; (4) disease of those parts of the skeleton which are carried by the pelvis; (5) disease of those parts of the skeleton which carry the body-weight (See Classification, page 617.) The normal adult pelvis is the complicated outcome of a combination of various factors. (See The Passages, page 391, Part IV.)

Classification and Description of Different Varieties.—Classification has been many times attempted, but with most unsatisfactory results. Different bases of classification have been taken,—*e. g.*, the causes or effects,—but the variations are so numerous that the simplest and most scientific arrangement is based on the location and character of the deformity. The classification I adopt is practically Schauta's.

(*A*) *Anomalies of the Pelvis as a Result of Defective Development.*—I. Generally symmetrically contracted, non-rachitic pelvis, justo-minor or small round pelvis: (1) The infantile type; (2) the masculine or strong type; (3) the dwarf type. II. Simple flat, non-rachitic pelvis. III. Generally contracted flat, non-rachitic pelvis. IV. Narrow, funnel-shaped pelvis. Fetal or "lying-down" pelvis. V. Imperfect development of one sacral ala (Naegele pelvis).

* International Gynecological Congress at Geneva, 1896 (reported in "Centralbl. f. Gynäk.").

† Fochier, Pinard: Loc. cit. ‡ Loc. cit. § Pawlik: Loc. cit.

‖ Hugenberger: "Petersburg. med. Wochen.," 1872, III.

** Pestalozza: Geneva Congress, 1896. †† Treub: Geneva Congress, 1896.

VI. Imperfect development of both sacral alæ (Robert pelvis). VII. Generally equally enlarged pelvis, justo-major pelvis. VIII. Split pelvis.

(*B*) *Anomalies of the Pelvis as a Result of Disease of the Pelvic Bones.*—I. Rachitis. II. Osteomalacia. III. New growths. IV. Fracture. V. Atrophy, caries, necrosis.

(*C*) *Anomalies in the Function of the Pelvic Bones.*—I. Synostosis at the symphysis. II. Synostosis at one or both sacro-iliac joints. III. Synostosis at the sacro-coccygeal joint. IV. Exaggerated motion or separation of the pelvic joints.

(*D*) *Anomalies of the Pelvis due to Disease of those Parts of the Skeleton which are Carried by the Pelvis.*—I. Spondylolisthesis. II. Kyphosis. III. Skoliosis. IV. Kypho-skoliosis. V. Assimilation. VI. Lordosis.

(*E*) *Anomalies of the Pelvis due to Disease of the Weight-bearing Parts of the Skeleton.*—I. Coxitis. II. Luxation of the head of one femur. III. Luxation of the heads of both femora. IV. Unilateral or bilateral club-foot. V. The absence or deformity of one or both lower extremities.

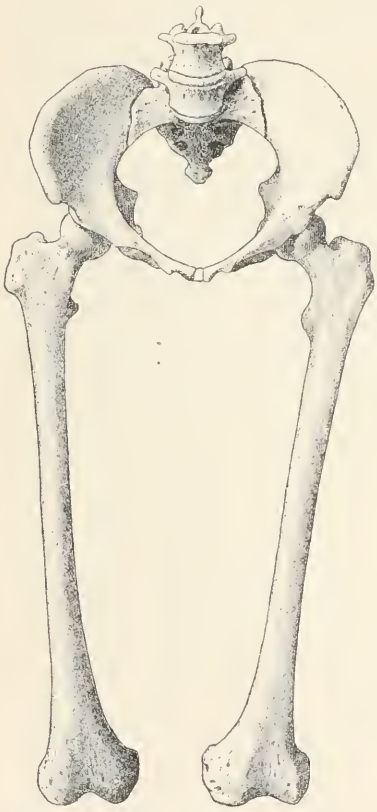

Fig. 811.—Generally Symmetrically, Non-rachitic, Contracted Pelvis. Justo-minor or Small Round Pelvis.

A. ANOMALIES OF THE PELVIS THE RESULT OF FAULTY DEVELOPMENT.

I. Generally Symmetrically Contracted, Non-rachitic Pelvis. Pelvis Æquabiliter Justo-minor, or Small Round Pelvis (Figs. 811, 814).—In the generally contracted pelvis the female shape is preserved but the size is diminished. Under this heading are grouped three sub-varieties. (1) The *infantile* or *juvenile type*, the bones of which are delicate and small; (2) the *masculine type*, strong pelvis, the bones of which are strong and large; (3) the *dwarf type*, which is extremely small, and whose bones, like those of the infant pelvis, are connected by cartilaginous instead of bony union (Fig. 813).

The divisions between the innominate bones are distinct, as well as those between the vertebræ of the sacrum. In this form of pelvis all of the diameters have their normal relations, but the measurements of the entire pelvis are less than normal. This pelvis merges very gradually into other forms, as the generally contracted flat, the simple flat, and the transversely contracted pelvis.

Frequency and Etiology.—This type of deformity is often found, particularly in the class frequenting the free hospitals and dispensaries. It is the most frequent type in America. I found it in 2.50 per cent. of my cases. These women have been born to hard work and unhealthful environment. However, this malformation is sometimes met with in those who are otherwise well formed.

Clinical Characteristics.—The transverse concavity of the sacrum is increased; the sacral promontory is pushed upward, but is not prominent. While the posterior superior iliac spines are further apart than normal, the iliac crests and spines are closer together. The transverse diameters are decreased; the conjugate of the superior strait is shorter than normal; the side walls of the pelvis can be so easily felt that it is not uncommon for the finger to be able to follow the iliopectineal line. This form of pelvis is not, strictly speaking, a copy of the normal adult pelvis in small dimensions, for it has some of the characteristics of the infantile pelvis. As a rule, women with the generally contracted pelvis are short in stature and slender, but there are exceptions. In the forms of the generally contracted pelvis most commonly seen the contraction is usually slight. In certain instances the pelvic outlet is contracted transversely. The dwarf variety is most unusual, and is found only in dwarfs.

FIG. 812.—ACHONDROPLASIC DWARF. —(*Depaul.*)

Diagnosis.—The generally contracted pelvis can be easily differentiated from any other deformed type—the rachitic, for example—when it is remembered that the measurements, although less than normal, are symmetrically so. There is one possible exception only—the external conjugate diameter; this,

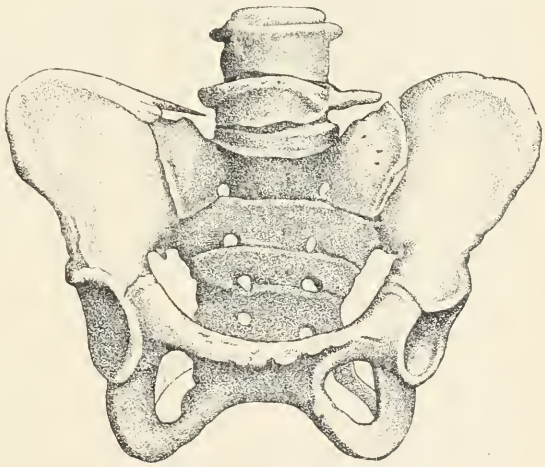

FIG. 813.—DWARF PELVIS.

on account of the peculiarities of the sacrum, which is not situated so anteriorly as the normal, may be longer than usual. Another important measurement is that of the pelvic circumference, which is always much less than normal. The internal examination should be carefully made, especially the estimation of the transverse diameters.

Prognosis.—Difficulty begins with the onset of labor and increases with its progress. The head is overflexed with a consequent prominence of the posterior fontanelle, while the sagittal suture lies commonly in an oblique diameter (Fig. 639). Descent is slow, but there is rarely the lateral obliquity which is seen in flat pelves. Breech presentations are especially to be dreaded

in this form of pelvis, for it is very difficult to free the legs and arms, and to bring the head down through the contracted canal. Although the mother does not suffer from injuries to the soft parts which are incident to labor in some forms of contracted pelvis, still the pelvic joints are liable to be ruptured and eclampsia is very common. As for the child, the caput succedaneum is of unusual size and is just over the smaller fontanelle. The cranial bones greatly overlap (Fig. 582).

II. Simple Flat, Non-rachitic Pelvis (Fig. 894).—A frequent form of deformed pelvis consists in the shortening of the antero-posterior diameter. This variety is common and was the first contracted pelvis to be recognized. It was not till later that the distinction between it and the rachitic flat pelvis was made clear.

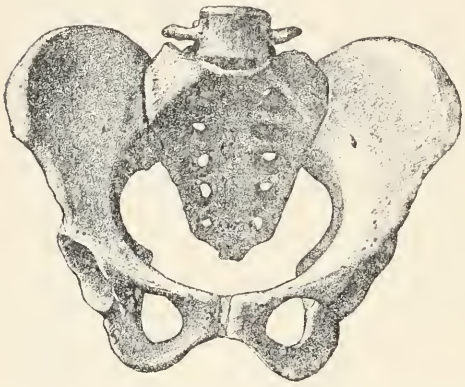

FIG. 814.—SYMMETRICALLY CONTRACTED PELVIS FROM COMPLETE ASSIMILATION OF THE FIFTH LUMBAR VERTEBRA WITH THE SACRUM.

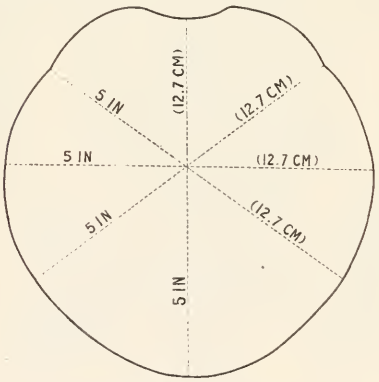

FIG. 815.—DIAGRAM OF PELVIC INLET OF FIG. 814.

Frequency and Etiology.—The etiology is obscure, although, as a rule, this type of pelvis is probably congenital. It is a very common type and is found as often among the upper classes as among the lower; and it is also as common in the otherwise well-formed woman as in the stunted. Various predisposing causes of this deformity have been suggested, such as overexertion in youth; excessive burden-bearing; the combination of weak pelvic ligaments and a heavy trunk; arrested rachitis. It is probable that heredity is an important factor, for it has been noted frequently in newly born children and fetuses.

Clinical Characteristics.—It is only the antero-posterior diameter in this pelvis which departs from the normal, the other pelvic diameters being as a rule undisturbed. The degree of distortion is never great. The sacrum is displaced forward to a slight degree and the cartilage between the second and third sacral vertebræ is unusually prominent, often making a double promontory. The mutual relations between the iliac crests and spines are almost *nil.* Contrary to the condition in the generally contracted pelvis, vaginal palpation will reveal the lateral pelvic walls only with difficulty. The pelvis is perfectly symmetrical.

Diagnosis.—Unless there has been difficulty in previous labors there will be nothing but the measurements to call attention to the condition, which is easily overlooked. In the presence of a double promontory the one nearest the symphysis must be used in measuring the conjugate.

Prognosis.—Pendulous abdomen is often present in this form of pelvis. Labor need not be seriously interfered with, although instrumental delivery may be necessary under certain conditions, such as feebleness of the uterine con-

tractions or oversize of the fetal head. The first stage is generally protracted, for the head is longer than usual in engaging. After engagement has taken place, the course of labor runs smoothly, although the maternal strength may have been much exhausted by the demands made upon it before engagement took place. This condition of affairs will, of course, naturally protract the course of labor. The head accommodates itself to the shape of the pelvis; this accounts for its transverse position and slight extension as it enters the pelvis; which allows the palpation of the bregma (Fig. 645). The anterior parietal position is assumed, since the sagittal suture is brought near the sacral promontory (Figs. 685 and 686). Very infrequently the head assumes the posterior parietal position, so that the sagittal suture approaches the symphysis (Figs. 688 and 689). This is generally confined to primiparæ. Early rupture of the membranes is frequent. It is probable that in the majority of cases labor terminates spontaneously. Faulty presentations and prolapse of the cord or extremities frequently occur. Necrosis of the maternal soft parts may be expected from the long pressure to which they are subjected. As to the child, although the caput succedaneum is not extreme, there are often depressions or grooves on the head varying with the position of the pressure to which it has been subjected.

III. Generally Contracted Flat, Non-rachitic Pelvis (Fig. 895).—As the name indicates, this pelvis is characterized by the peculiarities of both the generally contracted and the flat pelvis.

Frequency and Etiology.—This pelvis results from congenital defect but not from rachitis, and is rather common. Some authorities believe that it can be caused by too early walking or long standing on the feet in the first years of life.

Clinical Characteristics.—With the exception of the diagonal conjugate, which may be increased on account of the elevation of the sacrum, all of the diameters are decreased, particularly the conjugate of the inlet. The sacrum is small, its promontory is much elevated but not prominent, while its position is considerably posterior in comparison with the normal. The alæ as well as the innominate bones are not fully developed. Two points should serve to differentiate this type from the rachitic pelvis—the abnormally posterior position of the sacrum and the fact that the anterior half of the pelvic circumference is only slightly broadened. Otherwise there are various points of resemblance between this and the rachitic pelvis. The entire pelvis is smaller than normal. The mechanism of labor is similar to that in flat pelves.

Diagnosis.—An absolute diagnosis can be made only by the direct measurement of the various diameters, and is even then difficult. Although these diameters throughout bear a resemblance to those of the generally equally contracted pelvis, the diagonal diameter is an exception, being longer in the last-named. This factor, together with the ease with which the side walls of the pelvis can be reached by the internal finger, will help in the diagnosis.

Prognosis.—More difficulty in labor is experienced in this pelvis than in the simple flat variety, for the oblique diameters do not afford extra room for the head of the fetus, the whole pelvis being undersized.

IV. The Narrow, Male, Funnel-shaped Pelvis; Fetal or Lying-down or Undeveloped Pelvis (Fig. 816).—The name suggests both the shape and the etiology of this type of pelvis. The subject of funnel-shaped pelvis has been much neglected.

Frequency.—This has been considered an exceedingly rare variety, but is often found when the pelvis is systematically measured. Schauta estimated 5.90 per cent. of funnel pelves in 5000 cases.

Etiology.—It is due to the absence of the forces upon which the evolution of

the normal pelvis depends. (Page 391.) Those unfortunates who, owing to infantile paralysis or for other reasons, have never walked are the ones in whom it is most markedly found. A suggestion of this type is also sometimes found in very young girls. Schauta pointed out the fact that this pelvis is generally due to maldevelopment by which the walls of the pelvis are lengthened and the body-weight is thrown backward on the sacrum.

Clinical Characteristics.—The characteristics of the fetal pelvis persist—usually length and narrowness of the sacrum and elevation of the promontory which gives a longer diagonal conjugate than usual. The whole pelvis is very narrow and deep and there is not the normal width at the hips. The sacrum is unusually straight. The transverse diameter of the outlet is contracted, and Schauta showed that contraction in the pelvic outlet may be in any diameter. The sacrum is far back between the iliac bones. The spinal column is normal.

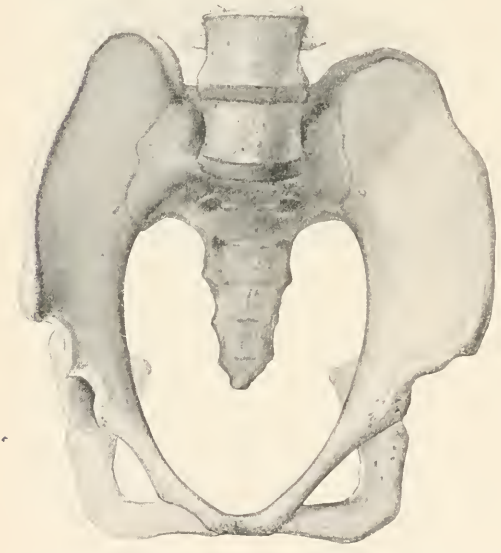

FIG. 816.—NARROW, MALE, FUNNEL-SHAPED, FETAL OR LYING-DOWN PELVIS.—(*Ahlfeld.*)

Another Form of Funnel Pelvis.—A kyphosis in the upper vertebræ gives a lordosis in the lower part. If the kyphosis is lower, the influence on the pelvis is marked. Suppose the kyphosis is in the lumbar region, there is no compensatory lordosis, but in order to enable the patient to stand upright there are changes in the pelvis causing an enlargement at the superior strait. Rotation of the sacrum backward causes an increase in the superior and a decrease in the inferior strait. The pelvis assumes more or less the horizontal position. The iliac bones are spread apart by the sacrum, causing the distance between the spines and crests to be increased. Great tension is put on the iliosacral ligaments, causing a drag on the ischia, tending to spread the bones above and causing a contraction below from side to side. Hence the pelvic outlet is diminished both transversely and antero-posteriorly. The tension is on the iliofemoral ligaments, and this throws the ilia outward and the ischia inward. A kyphosis, in order to produce this, must take place in early life. Later, the pelvis is tilted but no such change takes place.

Diagnosis.—The diagnosis may be easy if measurements are taken. Usually the deformity is overlooked. The kyphosis itself should give the clue. The measurements of the inlet and outlet must be compared. (See Pelvimetry.) The diameters of the outlet are less than normal, while those of the inlet are normal or even greater. When this deformity exists in an extreme degree, so that the inlet and the pelvic cavity are contracted, there is a still greater degree of contraction, comparatively speaking, in the outlet. The internal examination of the pelvic canal is of great service in making the diagnosis, for it will clearly reveal the shelving walls converging toward the outlet, the contraction of the pelvic arch, and the close relation of the ischiac tuberosities and spines.

Prognosis.—In more than one-half of the cases labor has terminated fatally. It may be possible to deliver with forceps, since spontaneous delivery takes place only in the slightest degree of this deformity. If the transverse diameter is less than three inches (7.62 cm.) and the antero-posterior diameter is also contracted, symphyseotomy is indicated, while still greater contraction will demand Cæsarean section. Hence in these forms the ordinary means of pelvimetry are not sufficient for making the diagnosis. If the diagnosis is not made, the child will be dragged out through the contracted outlet. Faulty positions of the head at the outlet are common. The power of expulsion is generally weak. Lacerations and necrosis of the soft parts are most frequent, and on account of the convergence of the pubic rami there is great danger of perineal laceration.

V. Imperfect Development of One Lateral Mass of Sacrum. Naegele's Pelvis. Obliquely Deformed or Contracted Pelvis. Obliquely Ovate Pelvis. Single Oblique Pelvis (Figs. 817, 818, 819, 820).—Naegele first described this in 1806, and published a work in 1839 in which he had collected some thirty cases.

Frequency and Etiology.—By many obstetricians this pelvis is considered extremely rare, but careful observation will result in the discovery of one or two in the course of the average practice in obstetrics. There are two theories as to etiology: (1) Failure of development of the alæ of the sacrum on one side from absence of bony nuclei; (2) inflammatory changes in the same place causing synostosis. Reasons for the congenital view are: (1) Such deformities have been observed in intrauterine life; (2) if it were due to inflammation, traces of this trouble would be left behind—but these are not found. The direction of distortion of the innominate bones is upward and backward on the sacrum. This condition would not be possible in the presence of primary ankylosis. The atrophy of the part embraces the whole length of the sacrum. It is to-day accepted that the first theory is the correct one. The ossification of the bones is secondary. Even children having this deformity before ankylosis takes place have the oval pelvis, because the well side in developing draws over the affected side. As soon as the patient begins to walk, the body-weight is applied more to the leg of the diseased side, causing an adhesive inflammation leading to synostosis. Sometimes this union does not take place, but the pelvis is deformed notwithstanding.

Clinical Characteristics.—The sacral ala on the deformed side is atrophied or entirely wanting, while there exists a synostosis between the sacrum and the iliac bone. The asymmetrical narrow sacrum faces the deformed side, the promontory being actually twisted over toward the contracted side. The pelvic inlet is oval in shape, with the tapering end on the deformed side (Fig. 819). The crests of the pelvis are markedly asymmetrical. The symphysis is deflected from the middle line to the unaffected side, while the pubic arch is contracted and deflected (Figs. 819 and 902). The external surface of the symphysis faces toward the diseased side instead of directly forward. The ilio-pectineal line of the affected side is almost a straight line, while the ilium on the sound side has a greater curve in its anterior part than normal, but in every other particular is practically unchanged. The posterior superior spine of the ilium approaches the sacral spines. The oblique diameter drawn from the superior posterior spine of the ilium of the deformed side to the anterior superior spine of the normal side is increased (Fig. 820). Careful internal pelvimetry will detect considerable decrease in the oblique diameter drawn from the point just above the center of the obturator foramen on the contracted side to the opposite sacro-iliac synchondrosis. Pressure of the femur

on the diseased side is exerted in an upward direction, so that the innominate bone is pressed upward and inward, while on the sound side femoral pressure is directed upward and outward. Thus the sound side is enlarged. This fact is of importance because in the mechanism of labor there is only one side of the pelvis for the fetus. The normal true conjugate plays no part. The diameter to be considered skirts the posterior wall at the sacro-iliac synchondrosis. There is no shortening of the true conjugate, and therefore these pelves are often unrecognized.

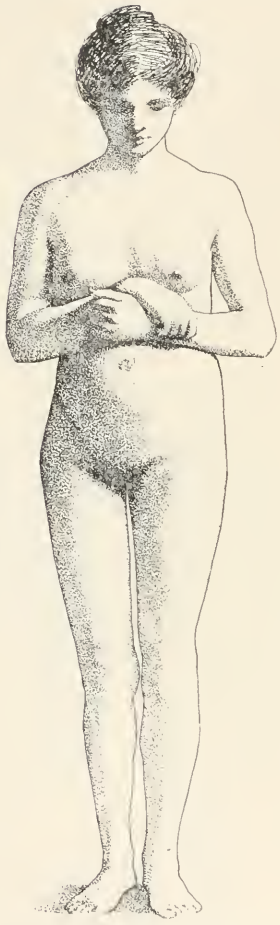

FIG. 817.—OVAL OBLIQUE PELVIS OF NAEGELE.—(*Budin.*)

Diagnosis.—This is readily made in routine pelvic examinations, although without careful measurements the deformity may be easily overlooked. In the internal examination the asymmetry ought to be recognized by the ischial spines. The contracted pubic arch and distorted promontory would also be noticed.

FIG. 818.—OVAL OBLIQUE PELVIS OF NAEGELE. PELVIC INLET.—(*Author's collection.*)

The distance is measured from the spine of the last lumbar vertebra to the anterior superior spines of the ilia, and from the last lumbar spine to the posterior superior spine. Then the measure is taken from the anterior superior spine of one side to the posterior superior spine of the opposite side; from the posterior superior spine of the ilium on one side to the tuber ischii on the other; from the posterior superior spines of the ilia to the inferior edge of the symphysis pubis; from the inferior edge of the pubis to the spines of the ischium, and again from the spines to the nearest sacral borders. The longest measurement between the ischial spines and the inferior border of the pubis is on the decreased side, while the reverse is true of the distance between these spines and the sacrum.

The majority of these cases have been diagnosed after death. Zweifel believes the diagnosis to be free from difficulty when there is a great difference between the sides. The patient may exhibit no limp in her gait, but a careful history of her early life should be obtained. Physical examination may also reveal healed sinuses. A rectal examination is valuable for detecting an ankylosed joint. Externally the most valuable measurement is that from the trochanter major of one side to the iliac crest of the other, and vice versa.

Prognosis. — The results are usually fatal. Probably two-thirds of the cases passing into labor have ended in death. If the deformity is great, the child must pass through the healthy side of the pelvis, as the contracted side is not large enough to admit any part of the fetus. The mechanism is similar to that of the generally contracted pelvis. The occiput descends first, as the head is extremely flexed. If the breech presents, the prognosis is more unfavorable, for it may be impossible for the head to pass. The mortality of the mothers is 80 per cent., according to Litzmann. The prognosis in respect to the mother will necessarily depend upon several factors. Eighty per cent. as quoted is thought to be too high for maternal mortality, and it is to be accounted for by the use of inappropriate treatment, and also by the fact that often the condition was not recognized

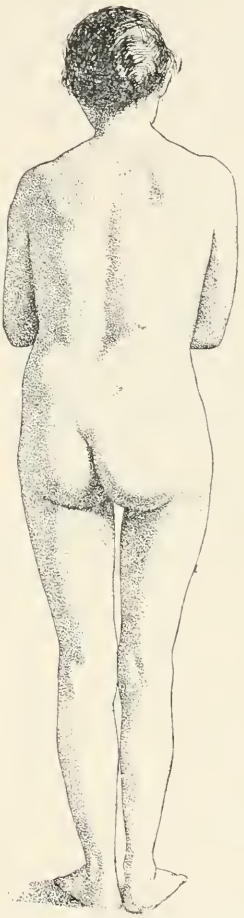

FIG. 819.—OVAL OBLIQUE PELVIS OF NAEGELE.—(*Budin.*)

FIG. 820.—OVAL OBLIQUE PELVIS OF NAEGELE. PELVIC OUTLET.—(*Author's collection.*)

early enough for the use of suitable therapeutic measures. Various accidents are apt to take place during labor, such as ruptures, fistulæ, fractures, etc.

Treatment.—This differs according to the extent of the deformity. If the inferior strait is contracted, Cæsarean section should be performed. Farabeuf recommends ischio-pubotomy. (See Operations, Part X.) If the attendant is in doubt, Cæsarean section should be performed, since unless the degree of deformity is slight, forceps and version are not generally attended by good results.

VI. Imperfect Development of both Lateral Masses of the Sacrum, Robert's Pelvis. The Ankylotic Pelvis. Transversely Contracted Pelvis (Figs. 821, 822).—Robert was the first to describe this pelvis in 1842. It is closely related to the Naegele pelvis. *Frequency and etiology:* This is the rarest of contracted pelves, only eight cases having been reported. It is due to failure of development of the sacral alæ on both sides. There is generally synostosis on both sides, and the sacro-iliac synchondrosis is absent. *Clinical characteristics:* The sacral alæ are either absent or poorly developed. The narrow sacrum has an extremely elevated promontory, felt on internal examination. The spines and tuberosities of the ischium are more closely approximated than normally. The transverse pelvic diameters are much decreased, while on account of the slight anterior displacement of the sacrum the conjugate of the superior strait is diminished. The transverse diameter of the inlet is particularly shortened, varying, according to Kleinwächter, from 2.76 to 3.94 inches (7 to 10 cm.), while that of the outlet is from 0.88 to 2.76 inches (2.25 to 6 cm.). The pubic angle is diminished. Asymmetry of the Robert pelvis sometimes exists. *Diagnosis* is based upon the above condition. *Prognosis:* Cæsarean section with its attendant dangers is nearly always indicated. *Treatment:* Perforation and extraction may be performed within certain limits, a case in which the transverse diameter of the pelvic inlet measures 3.1 inches (7.8 cm.) and that of the outlet 2 inches (5 cm.) is supposed to represent the extreme limit of its applicability. Cæsarean section has been performed in the majority of the cases.

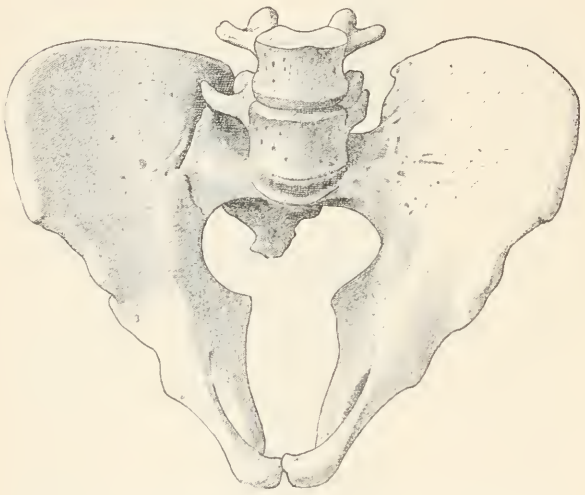

Fig. 821.—Double Oblique Pelvis of Robert.

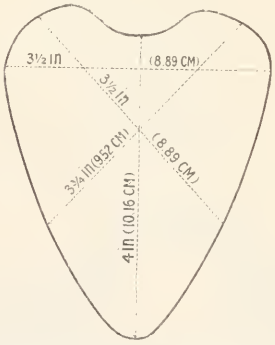

Fig. 822.—Double Oblique Pelvis of Robert. Diagram of pelvic inlet of Fig. 821.

VII. Generally Equally Enlarged Pelvis. Pelvis Æquabiliter Justo-major. Giant Pelvis. Justo-major Pelvis (Figs. 823 and 824).—This pelvis is occasionally observed in women of medium height, although it also sometimes accompanies a gigantic stature. *Frequency and etiology:* This condition is often merely congenital, with no other particular explanation. *Clinical characteristics:* In this pelvis all the diameters, although preserving normal proportions, are increased. The condition is seldom noticed, especially if not present in an extreme degree. During pregnancy the woman is liable to have increased pressure symptoms. This is due to the low position of the uterus in the roomy pelvis. Constipation, urinary symptoms, œdema of the vulva, varicose veins, and difficult locomotion are common in pregnancy. *Diagnosis:* This is rarely made, but if measurements show a general and symmetrical increase, diagnosis of a justomajor pelvis is justifiable. The promontory cannot be reached by internal examination, nor are the side walls of the pelvis easily accessible. *Prognosis:* Labor is usually not disturbed by this anomaly, although the majority of obstetricians consider that delivery is apt to be precipitate on account of the large size of the birth canal.

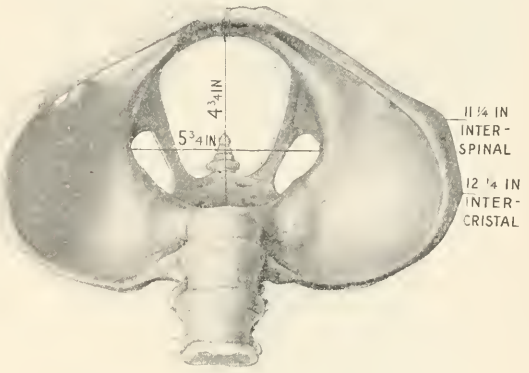

FIG. 823.—GENERALLY EQUALLY ENLARGED PELVIS. JUSTO-MAJOR PELVIS. PELVIC INLET.—(*Author's collection.*)

VIII. Split Pelvis. Inverted Pelvis (Fig. 825).—The name and illustration indicate the deformity. *Frequency and etiology:* This condition represents an anomaly of non-union, comparable and usually associated with such malformations as exstrophy of the bladder, myelomeningocele, etc. As a complication of labor it is one of the rarest of pelvic anomalies. *Clinical characteristics:* Although the deformity of this type most frequently concerns the symphysis pubis, still in some cases the sacrum as well as the lower part of the vertebral column is fissured at birth. In the separation of the pubic bones the heads of the femora, pressing upward, force the innominate bones outward and backward, resulting in the approach of the posterior superior spines of the ilium behind the sacrum, which is pushed inward. Thus there is created a groove posterior to the sacrum, from which circumstance this variety of pelvis receives the name of "inverted" pelvis. The space where the bones fail to meet is usually filled with fibrous tissue. Exstrophy of the bladder usually accompanies this

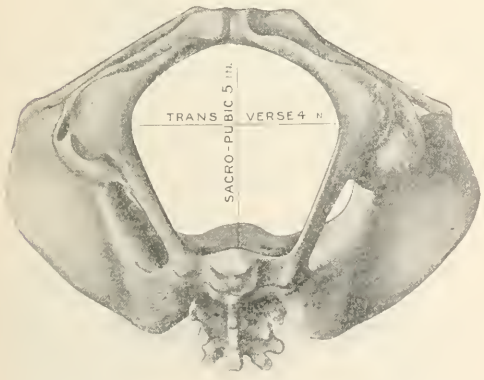

FIG. 824.—GENERALLY EQUALLY ENLARGED PELVIS. JUSTO-MAJOR PELVIS. PELVIC OUTLET.—(*Author's collection.*)

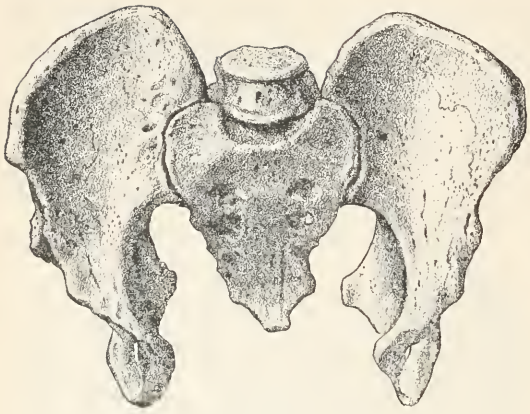

FIG. 825.—SPLIT OR INVERTED PELVIS.

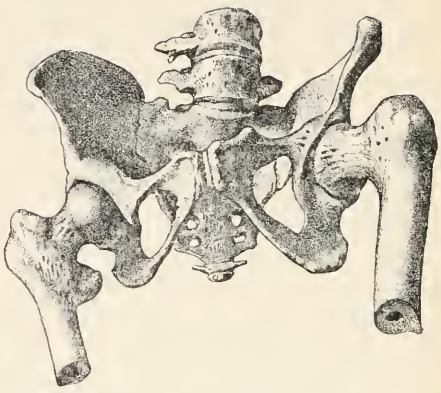

FIG. 826.—PELVIS DEFORMED FROM INFANTILE PARALYSIS OF THE RIGHT SIDE WITH ATROPHY OF THE CORRESPONDING FEMUR.

FIG. 827.—PELVIC INLET OF FIG. 826.

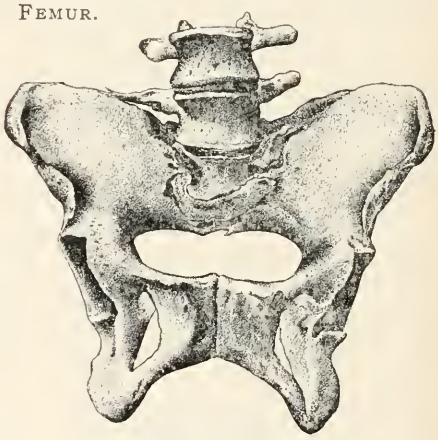

FIG. 828.—PELVIS DEFORMED FROM FAULTY DEVELOPMENT OF THE SACRAL VERTEBRÆ.

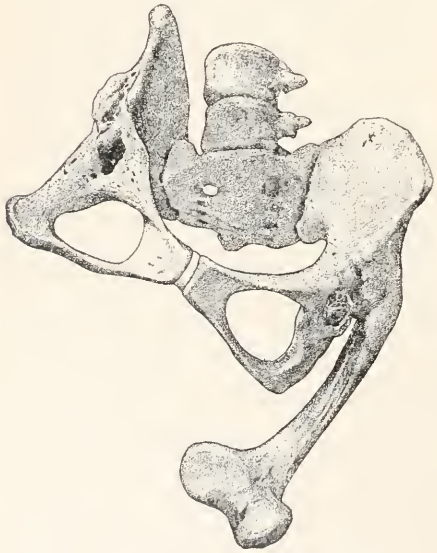

FIG. 829.—DEFORMED PELVIS FROM FAULTY DEVELOPMENT OF THE SACRUM.

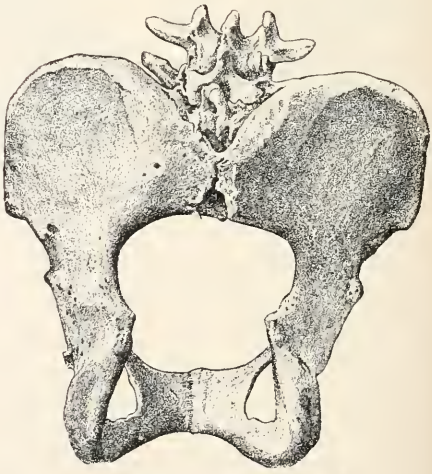

FIG. 830.—PELVIS DEFORMED FROM FAULTY DEVELOPMENT OF THE SACRAL VERTEBRÆ.

deformity. Not infrequently there are other congenital defects. It is not often that this pelvis is observed in a woman who bears children, though there are several recorded cases. The *diagnosis* is perfectly clear. *Prognosis:* No obstacle to labor is presented by the deformity, and it may be compared with the justo-major pelvis. There is no indication for obstetric *treatment* during labor. There is almost invariably prolapsus uteri after labor. In the case of cleavage of the sacrum there is often present a meningocele projecting into the pelvis which may offer a serious obstruction to the passage of the child.

B. ANOMALIES DUE TO DISEASE OF THE PELVIC BONES.

I. Rachitis or Rickets. Rachitic Pelvis.—This deformity has doubtless always existed. Hippocrates and Galen knew of it, but Glisson (1650) first

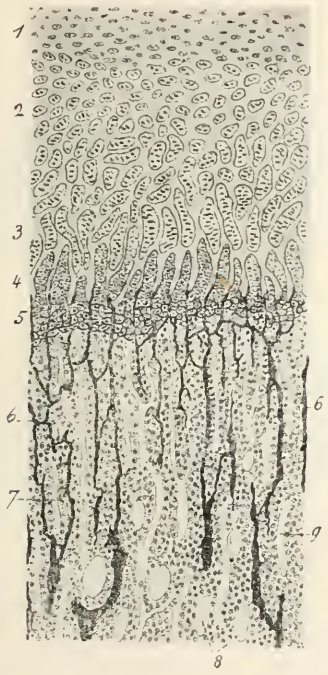

FIG. 831.—ZONE OF OSSIFICATION IN A NORMAL EPIPHYSIS (MICROSCOPIC): 1, Hyaline cartilage; 2, zone of beginning proliferation of the cartilage; 3, columns of cartilage-cells arranged in rows; 4, columns of enlarged cartilage-cells; 5, first zone of calcification; 6, layer of osteoblasts in first zone of ossification; 7, fully developed cancellous tissue (spongiosa); 8 and 9, blood-vessels in transverse and longitudinal section.

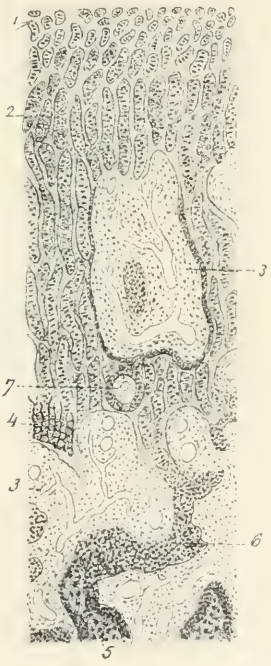

FIG. 832.—ZONE OF OSSIFICATION IN A RACHITIC EPIPHYSIS (MICROSCOPIC): 1, Transition of normal hyaline cartilage to proliferating cells; 2, zone of cartilage-cells arranged in rows; 3, cellulofibrous medullary spaces containing blood-vessels in the region of the proliferated and enlarged cartilage-cells; 4, island of calcified cartilaginous tissue; 5, columns of osteoid and fully developed calcified bone-tissue; 6, columns of osteoid tissue not containing lime-salts; 7, like 3, with the blood-vessel in transverse section.

described the disease. Rickets of the newly born child may be one of two varieties—fetal or congenital. It was the former that was familiar to the ancients, as the latter has been recognized only of late years. Both types of

this disease begin in intrauterine life, but while in the fetal form the stigmata of the disease are fully developed at birth, in the congenital form the evidences of the disease continue their development after birth. Fetal rachitis has been called a disease of the periosteal cartilage. There is an exuberance of growth of this part while the process of calcification is faulty. In rachitis the growth of the cartilage and subperiosteal tissue is defective as well as the process of calcification.

Frequency and Etiology of Rachitis.—From fifty to seventy per cent. of dispensary patients in Glasgow and Vienna exhibit traces of this affection. In America it is especially seen in the colored race. In the lower animals there occurs a disease similar to rickets. Malnutrition of the mother and deficiency in lime salts seem to be the most important etiological factors.

Pathology of Rachitis.—Bone is normally formed (1) under the periosteum, (2) from cartilage, (3) from the medullary canal. All of these may be affected by the disease. The essential fact is that there is excessive bone-formation while calcification is limited. Hence it is a primary disease—never caused by solution of pre-formed calcified bone. Roloff noted that in zoological gardens lions fed on meat without bones develop a similar condition (lähme) on account of the lack of calcium (Figs. 831, 832).

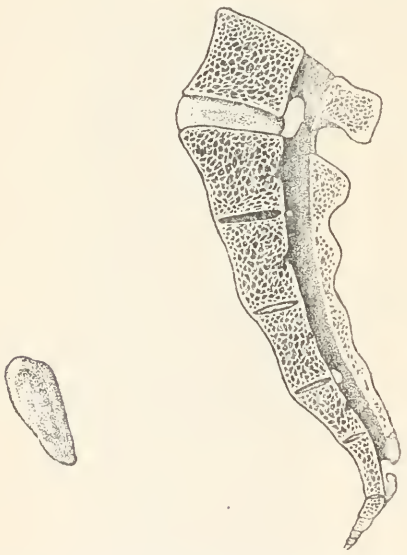

FIG. 833.—SAGITTAL SECTION OF A RACHITIC PELVIS. Note the false sacral promontories and the disappearance of the vertical concavity of sacrum.

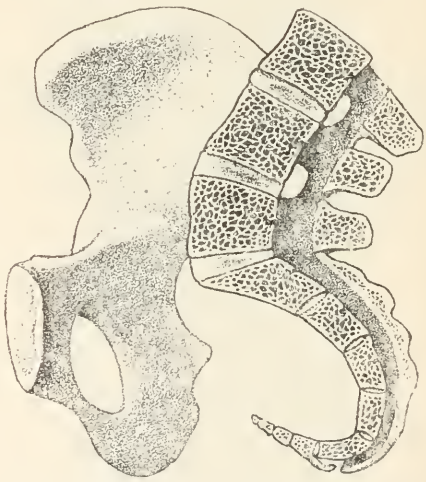

FIG. 834.—SAGITTAL SECTION OF A RACHITIC PELVIS. Contraction at the pelvic inlet with exaggeration of the vertical concavity of the sacrum.

Clinical Characteristics of Rachitis.—Rachitis is a disease of children occurring during the first three years of life. If the child has already learned to walk, it ceases to do so. Hence, one should always ask "When did the patient learn to walk?" The disease gives rise to soft bones, with their resulting deformities. The epiphyses of the long bones are enlarged ("knock-knee, rachitic rosary"). This is more marked on the pleural than on the pectoral side of the ribs. Pigeon-breast often results, especially if adenoids are associated. The head is more or less square or blunt. The bones of the skull have flat areas, which are thinned, and spoken of as craniotabes. Gastro-intestinal symptoms are marked and marasmus

may result. The various parts of the body are disproportionate, the abdomen being very large. Hydrocephalus and enlarged thyroid are often present. The pelvis and spinal column are subject to deformities. In certain cases the head is inclined laterally upon the axis of the spine. The long bones are often curved, while their spontaneous fracture is not uncommon. Diagnosis from recognition of the clinical characteristics as given above should be simple (Figs. 833, 834, 835).

Varieties of Rachitic Pelves.—There are several varieties of deformed pelvis resulting from the inroads of this disease. The most frequent is (1) flat rachitic pelvis, in which, although all of the diameters are shortened, the antero-posterior is most affected. (2) The simple flat, rachitic pelvis, in which the transverse diameters suffer no change. (3) The generally equally contracted rachitic pelvis. (4) The pseudo-osteomalacic pelvis, which comes to resemble the pelvis of osteomalacia from the effect of pressure on the soft rachitic bones. (5) Very rare forms of distorted pelves, in addition to the foregoing, result from rachitic affections of the spinal column.

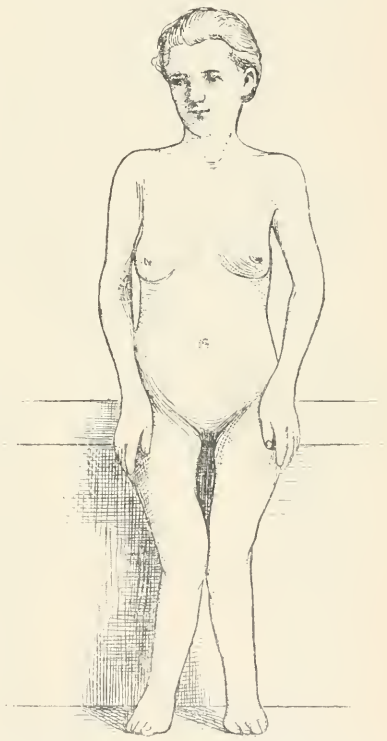

FIG. 835.—RACHITIC DWARF. DELIVERED BY CÆSAREAN SECTION.—(*Author's case.*)

Clinical Characteristics of Rachitic Pelves.—Three influences serve to modify the pelvis in rachitis: (1) Arrest of development occasioned by the progress of the disease; (2) the pressure exerted both by the superimposed and the subjacent skeleton; and lastly (3) the "pull" of the ligaments and muscles attached to the pelvic bones. The pelvis as a whole is undersized, having a distorted inlet which is often kidney-shaped or rarely like the figure 8. The pelvic cavity is very shallow. The pull of the obturator muscles upon the soft bones widens the pubic arch, and if great flattening is present, there will result the figure 8 pelvis. The promontory of the sacrum is abnormally prominent. The obliquity of the pelvis is greatly increased. The epiphyses are peculiarly altered, while the presence of other characteristics of rachitis adds to the certainty of the diagnosis. As a rule, the bones of a rachitic pelvis are abnormally fragile and small; rarely they are coarser and heavier than normal. (1) and (2) *Rachitic flat pelvis:* As a result of softening of the bones the child learns to walk late, or if it has walked ceases to do so for a time (Figs. 836, 837, 838, 839). The bones are soft and the child does not walk, but sits up; hence the pressure of the body-weight is not counteracted by the upward pressure of the femora. The broadening becomes marked and the transverse diameter is shorter than normal. The iliac bones are flared out so that the iliac spines are farther apart than the crests. The sacrum tends to rotate, imparting a backward impulse to the lower part, but this is offset by the firm grasp of the ligaments, and a curve is the result. Hence the antero-posterior diameter of the inferior strait is shortened. The bodies of the sacral vertebræ are pushed forward at

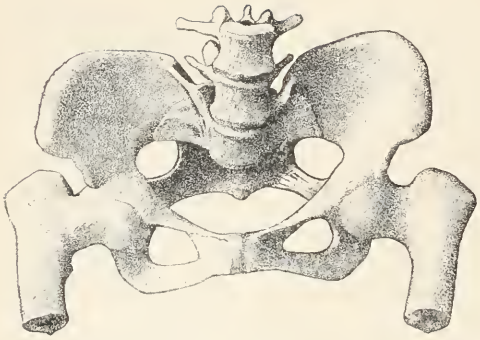

FIG. 836.—RACHITIC PELVIS. Diminution of all diameters, especially of the antero-posterior

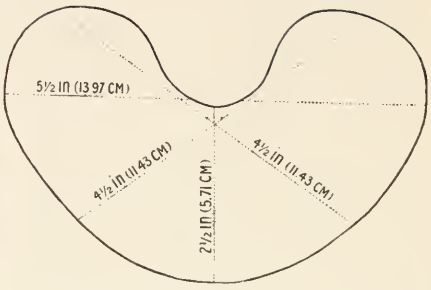

FIG. 837.—PELVIC INLET OF FIG 836.

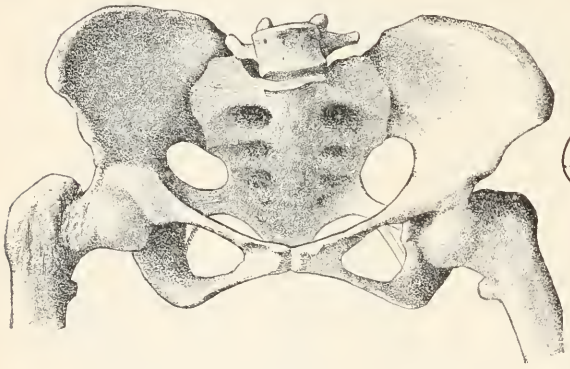

FIG. 838.—SIMPLE FLAT RACHITIC PELVIS. Note the false sacral promontories.

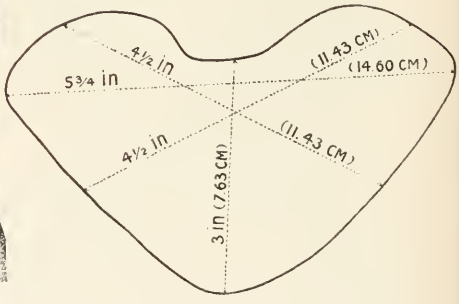

FIG. 839.—PELVIC INLET OF FIG. 838.

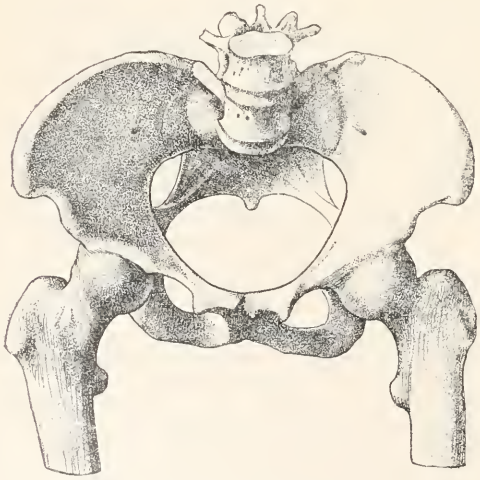

FIG. 840.—GENERALLY EQUALLY CONTRACTED RACHITIC PELVIS.

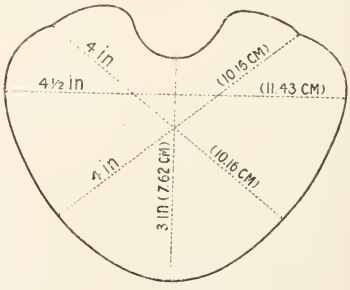

FIG. 841.—PELVIC INLET OF FIG. 840.

the expense of the alæ, making the anterior surface of the sacrum straight or convex. The child sits on the tubera ischii without the upward pressure of the femora to counteract, and the transverse diameter of the inferior strait becomes broadened, and there is also a flaring outward of the ischiac bones. The area of the superior strait remains about the same, but the relations are distorted. Owing to the backward movement of the sacrum, there is more room in the pelvis, although the external antero-posterior diameter of Baudelocque is less than normal. The interference with labor ends when the head has passed the superior strait. The effect of the deformity varies according to the extent. As to the measurements of the pelvis, a true conjugate, one less than $2\frac{1}{8}$ inches (5.5 cm.), is absolutely contracted; $2\frac{1}{2}$ inches (6.35 cm.) to 3 inches (7.62 cm.) is a deformity of the third degree; 3 inches (7.62 cm.) to $3\frac{1}{2}$ inches (8.89 cm.) is a deformity of the second degree, and the child may be born spontaneously or with the aid of the forceps; $3\frac{1}{2}$ inches (8.89 cm.) to $4\frac{1}{4}$ inches (10.795 cm.) is a deformity of the first degree, and the first child is usually born spontaneously. Contractions of the first degree are of little importance. The child's head is $3\frac{3}{4}$ inches (9.5 cm.) for the biparietal diameter, but this is capable of considerable shortening. In a flat rachitic pelvis the head is less flexed, being semi-extended. The two fontanelles are on the same level. The head becomes tilted in normal cases so that the sagittal suture lies nearer the promontory of the sacrum. This is called Naegele's obliquity. (Pages 518.) In flat rachitic pelves this is accentuated and the sagittal suture lies in front of the sacrum and the parietal bone presents—anterior parietal presentation. This increases till finally the ear is left behind the symphysis pubis. Then rotation takes place, causing the sagittal suture to leave the sacrum. In a few cases the sagittal suture is anterior. The complication is then more serious, as the head becomes wedged above the symphysis pubis. Whenever the two fontanelles are felt equally, a flat rachitic pelvis may be suspected. After the head has passed the superior strait the mechanism of labor is normal. Presentation by the posterior parietal bone is serious because the head is wedged on the symphysis pubis. The child cannot be born spontaneously.

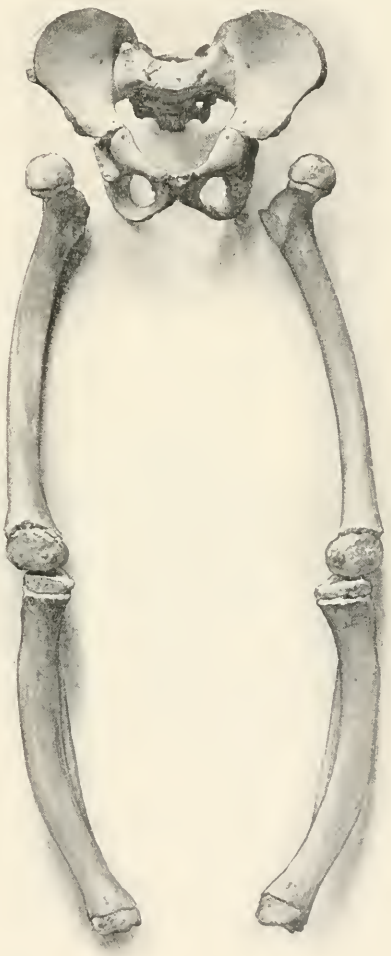

FIG. 842.—PSEUDO-OSTEOMALACIC RACHITIC PELVIS.—(*Author's collection.*)

Great pressure is exerted on the posterior parietal bone by the sacrum, causing a depression in the bone. Sometimes this depression is spoon-shaped. It is quite likely that the brain has been injured. By palpation only a vague idea of the size of the head can be obtained. (3) *The generally equally contracted rachitic pelvis:* It is chiefly characterized by arrested development (Figs. 840, 841). It entails contraction of the transverse diameter such as is seen in the fetal pelvis. This form is very rare and it leaves the shape of the pelvic brim little changed from normal, since the ravages of the disease have done their work at such an early age that the child did not sit up or walk till recovery had taken place. Consequently the processes which serve to change the shape of the pelvis when disease offers them in a favorable condition, have not had a chance to exert their influences. (4) *The pseudo-osteomalacic pelvis:* This is the result of several conditions the opposite of those considered in the last section (Fig. 842). The deformity of this type is striking, for the disease progresses while the child is walking and perchance carrying heavy weights (Fig. 842). From the action of the two forces, superimposed and subjacent, the pelvis is distorted to an extreme degree. The acetabula are pushed inward so that they encroach on the pelvic space. The innominate bones yield to the pressure exerted upon them and are bent laterally, while the sacrum is pressed downward and bent also in the same direction. The deformities are far advanced before the disease has exhausted itself, and the pelvis is fixed in its distorted form.

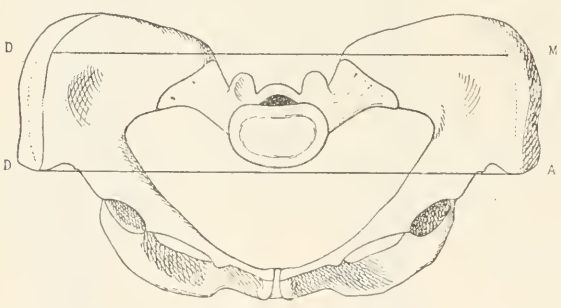

FIG. 843.—DIAMETERS OF THE ILIAC SPINES AND CRESTS IN A RACHITIC PELVIS COMPARED. D.M., Intercristal diameter; D.A., interspinal diameter.

Diagnosis of Rachitic Pelves.—Signs of rachitis in other parts of the body will make the diagnosis more clear. The history of infantile rachitis can also generally be elicited. The relative position of the crests and spines of the ilia is of important diagnostic significance (Fig. 843). The history and personal appearance must also be taken into consideration. After rachitis in childhood the woman is generally observed to be short with thick, curved limbs, enlarged joints, square head, and chicken-breast. The abdomen is short, and on this account, and because of the failure of engagement of the presenting part, when pregnancy occurs it hangs far forward and downward in a characteristic manner. Besides walking late, the rachitic child is late in teething. Not infrequently a double sacral promontory is observed in these patients. In some cases the lumbar vertebræ are curved inward so far that they offer an obstruction above the brim. This results from rachitis of the spine. In measuring the effective conjugate from the symphysis the outer point must be taken above the sacrum. To differentiate this pelvis from that of osteomalacia is not difficult, for there are characteristics belonging to the latter which clearly distinguish it, and, besides, the other rachitic signs come into play—those found elsewhere in the body and the direction of the crests of the ilia. After the disease has run its course the consistency of the bones is firm and hard.

II. Osteomalacia. Osteomalacic Pelvis (Figs. 844 to 848).—In English works the disease is called "malacosteon." The pelvis in a patient suffering from

this disease is called the "osteomalacic," "malacosteon," or "Y-shaped pelvis." It is also known as the "beak-shaped" or "rostrate pelvis." *Frequency and etiology:* It is rare in America but very common around the head-waters of the Rhine. Litzmann's statistics (1892) show that of 131 cases 11 were in males, 85 in pregnant or puerperal women, and 35 in non-pregnant women. It is essentially a disease of women, being in them about five times more frequent than in men. It occurs during pregnancy or during the puerperium. This disease is caused by the production of soft bone in the adult through the absorption of lime salts (Fig. 844). This bone is unable to resist pressure without being distorted into bizarre forms. It usually occurs between thirty and fifty years of age, in pregnant women or in those who have had children, and especially in those who have had many children. It is observed in animals kept in zoological gardens, where it is usually thought to differ from the similar condition in human beings. *Varieties of osteomalacic pelves:* The relative deformity from malacosteon may be expressed by several forms of pelves: (1) *Oblong*, in which the antero-posterior diameter is increased (Fig. 845); (2) *oblong rostrated*, oblong in shape

FIG. 844.—MICROSCOPIC SECTION THROUGH AN OSTEOMALACIC BONE. 1, Remains of calcified bone-substance; 2, decalcified bone-substance; 3, large medullary spaces due to the disappearance of bone-substance; 4, Haversian canals.

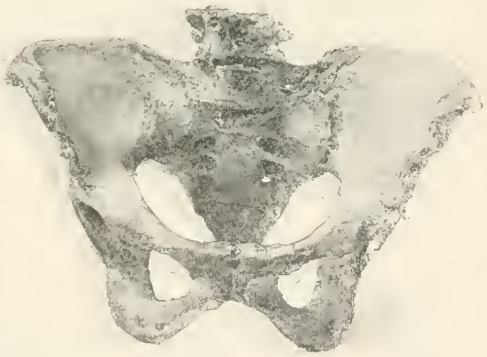

FIG. 845.—OSTEOMALACIC PELVIS. OBLONG INLET BEFORE MUCH DEFORMITY HAS OCCURRED. Weight of this pelvis fifteen ounces. Weight of healthy bony pelvis about thirty ounces.—(*Author's collection.*)

with anterior beak (Figs. 846, 847, 848); (3) *rostrated*, with beak in front; (4) *cordiform*, heart-shaped. This last form is very rare. *Pathology:* The old idea was that bones affected with this disease contain far less calcium than the normal bone. In 1895 Curatulo and Turelli made animal experiments. They estimated the total excretion of carbonic acid, lime, and phosphoric acid. Then they cut out the ovaries and found certain changes. The animals did not breathe so rapidly and excreted less lime and phosphoric acid. Hence it was shown the ovaries increase the excretion of these products. In 1896 Denecke estimated the amount of lime and phosphorus excreted by osteomalacic women; the ovaries were then removed. In a few weeks there was a marked decrease in the excre-

tion of these substances. In 1897 Senator recorded a case of osteomalacia. Excretion estimates were made and the diet carefully regulated, while thyroid extract was administered. It was found that the excretion of lime and phosphorus was increased. Ovarian extract caused an increase of nearly double that noted under the thyroid treatment. *Clinical characteristics:* The patient suffers from rheumatoid pains, inability to walk, and difficult labors. The pelvic bones become very soft so that in extreme cases they can actually be bent by the hand; they are also very painful. The pelvis naturally becomes much distorted and the symphysis pubis comes to resemble a beak, because the heads of the femora drive the innominate bones inward, while the symphysis is held in place by its muscular attachments. On internal examination the finger may be laid in the hollow of this deformity (Fig. 848). The pubic arch is much narrowed and the true conjugate is very short. The promontory of the sacrum is very prominent, being forced downward and forward, while the tip of this bone and the coccyx bend so sharply forward that the outlet of the pelvis is almost completely obstructed. The tubera ischii are displaced outward so that the transverse diameter of the outlet is increased. The patient suffers from dyspnea and cough. The bones become very porous and light, containing much cancellous tissue. This tissue contains large cavities, which may be from two to four millimeters in length. The pelvis actually collapses and the sufferer always loses markedly in height,—even as much as a foot in some cases,—while, unable even to stand, she is confined to her bed. It

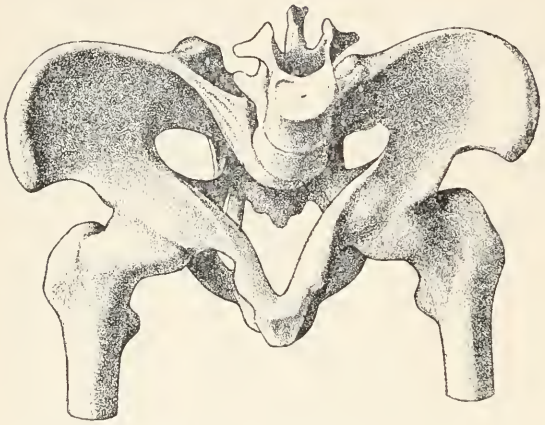

FIG. 846.—OSTEOMALACIC PELVIS. OBLONG ROSTRATED. PELVIC INLET.

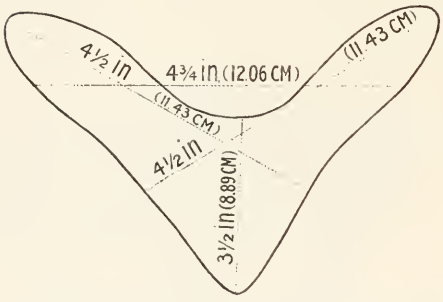

FIG. 847.—DIAGRAM OF PELVIC INLET OF FIG. 846.

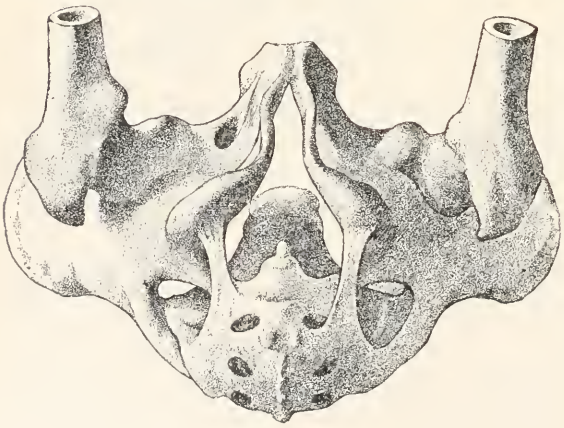

FIG. 848.—OSTEOMALACIC PELVIS. OBLONG ROSTRATED. PELVIC OUTLET.

occurs during pregnancy, its first signal being rheumatoid pains, and it may be diagnosed as rheumatism. This continues till the child is born, after which the woman is somewhat lame, and the trouble returns at the next pregnancy and difficult labor follows. The second child will probably be born dead while the following will be delivered by craniotomy or abdominal section. (See Osteomalacia in Diseases of Pregnancy.) *Diagnosis:* The length of the true conjugate is not a criterion of the capacity of the pelvis, but the diagnosis can be made by a review of the clinical symptoms together with careful internal and external examinations. The peculiar pains attendant upon this disease, the peculiarity of the gait, and finally the total inability to walk, the characteristic beak-like pelvis, with almost complete obstruction of the outlet, the loss of height, all make a striking clinical picture. Other types to be thought of in making the diagnosis are: the pseudo-osteomalacic, the Robert, the kyphotic, or a pelvis which has been fractured or invaded by malignant disease. *Prognosis:* It is not in itself a fatal disease. The patients usually die of inanition. The obstruction is very marked even though the bones are so flexible. Out of 85 cases reported by Litzmann, 47 were fatal. *Treatment:* If taken in the beginning, an improvement in surroundings is indicated, as are oleum morrhuæ and tonics. Phosphorus has been

Fig. 849.—Large Exostosis of the Pubis.

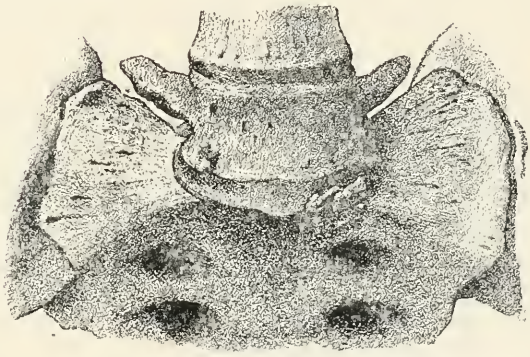

Fig. 850.—Exostosis of the Sacral Promontory.

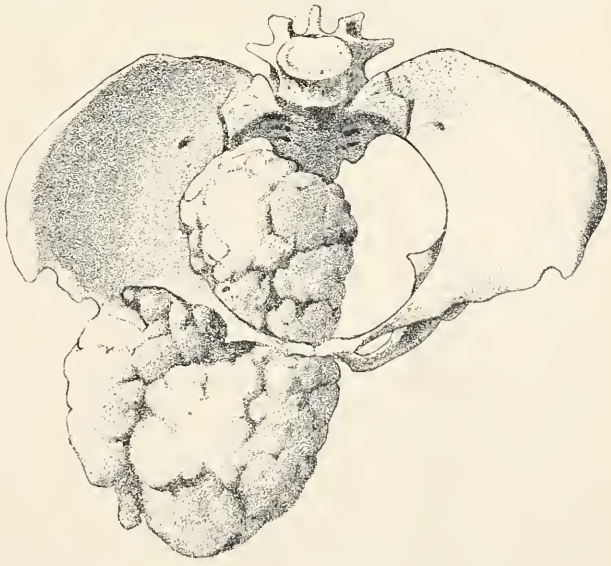

Fig. 851.—Osteosarcoma of the Pelvic Cavity.—(*Bar.*)

used. Ovariotomy ought to be done, especially as these women are usually very fertile. Hysterectomy gives the best result. Sometimes the suppression of the sexual functions may even cure the disease.

III. New Growths.—The presence of exostoses or other kinds of tumors of the pelvic bones is very infrequent. But such growths may be the cause of a high degree of dystocia. The pelvis with bony exostoses (Figs. 849 and 850) is known as acanthopelys, acanthopelvis, pelvis spinosa, spiny or thorny pelvis, and Hauder's pelvis. It is believed that exostoses are found, as a rule, in pelves otherwise deformed, and they are generally situated over one of the pelvic joints. In their original state they are composed of cartilage, afterward becoming bony. Most of them are small—about the size of a small bean or olive, though now and then they may attain the dimensions of a pigeon's egg. In some cases spicules of bone develop at certain points in the pelvis, projecting into its cavity. They are very apt to injure the uterus or the descending head. Perforation of the uterus is common under these circumstances. After fracture of the bones irregular callus may also form projections. Other pelvic tumors are osteosarcomata (Fig. 851), enchondromata, sarcomata, fibromata, cysts, and carcinomata. Their size will form the criterion for the difficulty offered in labor. The cysts may be hyda-

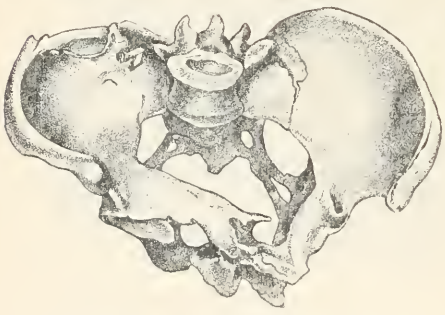

FIG. 852.—PELVIS DEFORMED BY MULTIPLE FRACTURES.—(*Von Martz.*)

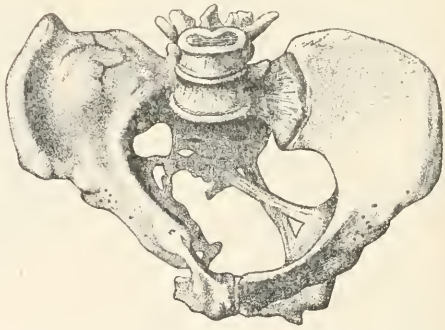

FIG. 853.—PELVIS DEFORMED BY MULTIPLE FRACTURES.—(*Paparoine and Tarnier.*)

tid or may be formed in enchondromata or sarcomata. Cancer is never primary. It may be an extension from the original focus or it may be metastatic. The growth may infiltrate the bones, making them porous and soft, as in osteomalacia. *Prognosis:* According to Winckel, in 49 cases of pelvic tumor obstructing labor, the maternal mortality was 50 per cent. while the fetal was 90 per cent. *Treatment:* Cæsarean section is generally performed, although the posterior vaginal wall has been excised and the growth removed by this route.

IV. Fractures.—Out of 13,200 fractures from the statistics of nine hospitals in England and America, only $\frac{8}{9}$ of 1 per cent. were fractures of the pelvis (Hirst). Contracted pelves may result from fractures and dislocations, whether congenital or occurring later. These pelves are not symmetrical, and when the traumatism has taken place very early are sometimes undeveloped, and are always accompanied by grave deformity. The contraction is found on the side of the fracture. Nearly all cases of serious pelvic fracture end fatally. The resulting deformity may be of various forms, depending upon the nature and seat of the fracture (Figs. 852 and 853). If the horizontal pubic ramus is broken, it is impossible to keep the broken ends together during repair, and thus great deformity may result. In unilateral dislocations the resulting pelvis

is obliquely contracted. A similar deformity is seen in the pelvis resulting from the early loss of one leg (Sitz pelvis, page 622, Fig. 816).

V. Atrophy, Caries, and Necrosis.—An oblique contraction occurs sometimes in the rare event of tuberculosis of the sacro-iliac joint. In affections of this joint there will develop the same result as that in a true Naegele pelvis from imperfect development of an ala of the sacrum. If the trouble takes place in early life, there will be loss of substance, arrested development of the part affected, and an anchylosed joint, all of which result in atrophy of the pelvis.

C. ANOMALIES IN THE JUNCTION OF THE PELVIC BONES.

I. Synostosis at the Symphysis.—The development of synostosis in this joint is quite common and occurs most often during early childhood. This condition would present a difficulty in the operation for symphyseotomy, but although it would limit the expansion of this joint which normally takes place during labor, it is not a serious complication in otherwise unobstructed labor.

II. Synostosis at One or Both of the Sacro-iliac Joints.—Synostosis of this joint occurring in early life is succeeded by badly developed sacral alæ on the abnormal side; the part of the innominate bone concerned in this joint suffers also in its development, so that there results an obliquely contracted Naegele type. Arrested development of the alæ of the sacrum as a primary occurrence is far more frequently seen than this latter affection. If, instead of taking place in early childhood, the synostosis does not occur till after puberty, the untoward effects may be considered of no consequence. In case this affection takes place on both sides, there results a pelvis much like the Robert. This is still less frequent than the transversely contracted pelvis, owing to faulty development of the sacral alæ.

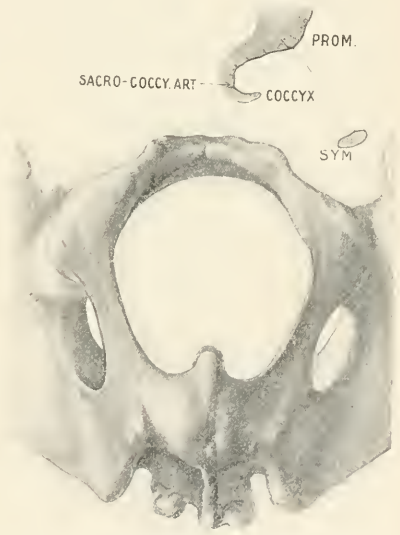

FIG. 854.—ANCHYLOSIS OF THE COCCYX.—(*Author's collection.*)

III. Synostosis at the Sacro-coccygeal Joint.—The joint between the sacrum and the coccyx is anchylosed, as a rule, between the thirtieth and fortieth years, but since the joint between the first and second coccygeal vertebræ does not take part in this process the effect on labor is scarcely worth considering. There is now and then a case in which anchylosis takes place in all the joints of the coccyx as well as in the sacro-coccygeal joint, especially in elderly primiparæ (Fig. 854). If labor occurs in such a patient, it will be necessary to fracture the coccyx or to break up the anchylosed sacro-coccygeal joint. The fracture sometimes takes place during the natural passage of the head down through the pelvic outlet, but it occurs more commonly in instrumental delivery.

IV. Exaggerated Motion or Separation of the Pelvic Joints.—This may be just an exaggeration of the normal condition of the joints during labor. However, it will more probably have a pathological foundation, such as inflammation of the joints, succeeded by suppuration, fluid in the joint, new growths, caries, or osteomalacia. During labor there is sometimes a predisposition of the joints to rupture on account of the relaxation incident to pregnancy and labor. Some-

times locomotion during pregnancy is made difficult by the relaxation of the joints. (See Part II.) The coccyx has been known to become dislocated during labor. This condition is productive of much pain, and often demands excision of the bone.

D. ANOMALIES OF THE PELVIS DUE TO DISEASE OF THOSE PARTS OF THE SKELETON WHICH ARE CARRIED BY THE PELVIS.

1. Spondylolisthesis. Spondylolisthetic Pelvis, Kilian's Pelvis, Rokitansky's Pelvis, Prague Pelvis (Figs. 855 to 860).—The term originated with Kilian, 1853, and is derived from spondylos (σπόνδυλος), vertebra, and olisthesis (ὀλίσθεσις), "a slipping out" or "down." Rokitansky, Kiwisch, and Seyfert had described the deformity, but Kilian gave the first accurate description. Neugebauer and Lane also did much work on the subject. To cause pelvic obstruction spondylolisthesis must take place in the lumbosacral region, and in obstetrics we understand the term to indicate a dislocation of the last lumbar vertebra in front of the base of the sacrum, so that the inferior surface, or possibly the anterior surface of the former, comes in contact with and is united by bony union with the anterior surface of the first piece of the sacrum. As a result a marked lordosis occurs in the lumbar vertebræ, and the fourth, third, and possibly the second lumbar vertebra may drop into the pelvic inlet, causing an obstruction in the antero-posterior diameter. Backward and downward displacement of the base of the sacrum and the posterior portion of the pelvic inlet results. Compensatory elevation of the anterior portion of the pelvis follows. The height of the symphysis is increased. Thus pelvic inclination is markedly lessened, and the vulval orifice is raised and directed more anteriorly. The amount of obstruction at the inlet will naturally depend upon the distance the last lumbar vertebra descends and the degree of lordosis. *Frequency and etiology:* It is not a common condition. Up to 1892 Schlesier collected fifty-three cases in skeletons, and many more clinically. It is a disease essentially of women, only three cases having been observed in men. The etiology is obscure. It is caused by violence, such as blows, excessive body-weight, the patients being commonly obese, and by the faults of development or ossification in the articular portions of the spinal column. The bones are often found to be healthy. *Clinical characteristics:* In most of the cases the anterior half of the fifth lumbar vertebra is pushed forward at the same time that the posterior part persists in its normal position at the lumbo-sacral joint (Figs. 855, 856, 857, 858). Now and then a case presents in which the whole vertebra is pushed forward. There are some cases in which an increased length of the vertebra is caused by a separation of the two extremities of the spondylolytic interarticular part and the space is filled in with fibrous tissue. The lordosis is marked (Fig. 857). The diminished pelvic inclination causes an undue strain on the ilio-femoral ligaments. In this way the ischial tuberosities are brought closer together than normal, while the crests of the ilia flare. Naturally the posterior superior spines of these bones flare also. The ribs and the brim of the pelvis become approximated and the height of the patient is decreased. The transverse diameter of the outlet is diminished while that of the inlet is increased. On internal examination the conjugate diameter of the inlet may be observed to be shortened. *Diagnosis:* This is seldom difficult. The patient has a deformity causing the distance from the costal margin to the pelvic inlet to be diminished. There is marked lordosis in the lumbar region. The spine of the last lumbar vertebra is more easily felt than normally. The transverse diameter of the pelvis is increased owing to the flaring of the iliac bones. There is a contraction of the pelvic

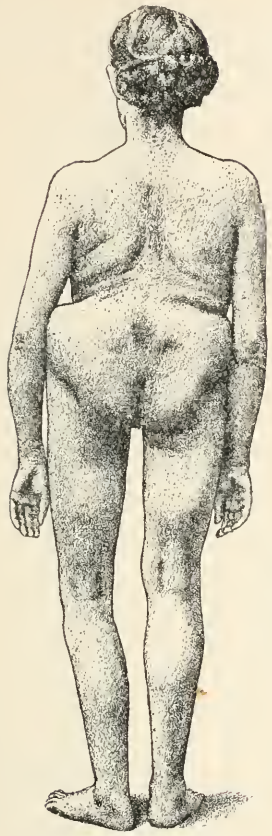

FIG. 855.—SPONDYLOLISTHESIS. POSTERIOR VIEW.—(*Budin.*)

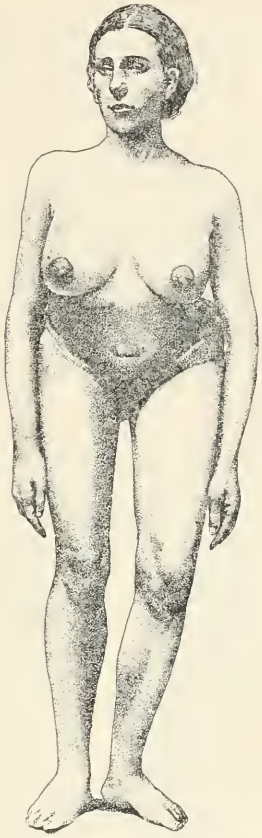

FIG. 856.—SPONDYLOLISTHESIS. ANTERIOR VIEW.—(*Budin.*)

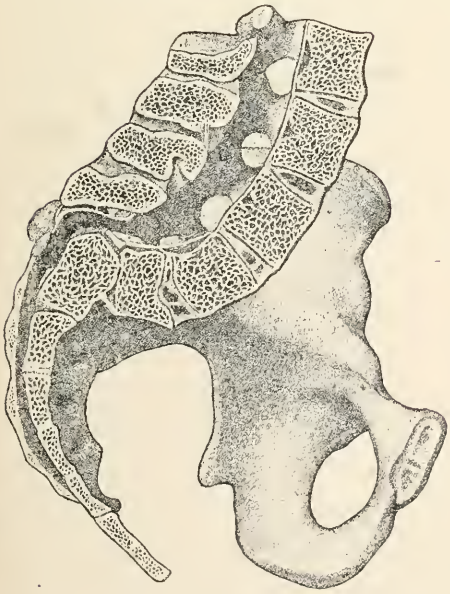

FIG. 857.—SAGITTAL SECTION OF A SPONDYLOLISTHESIC PELVIS.—(*Neugebauer.*)

FIG. 858.—SAGITTAL SECTION OF A SPONDYLOLISTHESIC PELVIS.—(*Neugebauer.*)

outlet. The contraction of the true conjugate is due not to the sacrum but to the lumbar vertebræ. The external conjugate is markedly diminished. The patient is rather short, having lost in stature. Neugebauer, in 1895, published

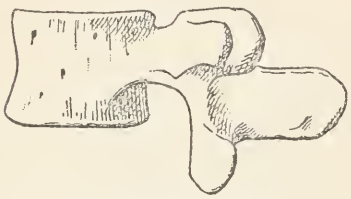

FIG. 859.—LUMBAR VERTEBRA OF NORMAL SHAPE.

FIG. 860.—LUMBAR VERTEBRA ELONGATED BY SPONDYLOLISTHESIS.

an article on "Ichnograms" or pictures of foot-tracks. In spondylolisthesis the steps are very short, and the legs, being converged, are put forward one in front of the other. The patient's appearance and history are very important. There may be the history of a fall or other accident, or the bearing of heavy weights. The buttocks, taken together, are curiously heart-shaped, being flattened and ending below in a point. The abdomen is pendulous and deeply creased above the symphysis. Looked at from behind, the patient presents a saddle-shaped back. Her gait is peculiar; she may feel top-heavy. There is sometimes crepitus in lumbar region (Fig. 855). *Prognosis:* The extent of the obstruction to labor depends upon the degree to which the pelvic cavity is encroached upon by the lumbar vertebræ. The effect of this pelvis on labor is similar to that of the flat pelvis. Lacerations, fistulæ, and tears are frequent. As the presenting part descends it strikes the middle part of the pelvic floor instead of sliding forward to the orifice of the vulva. *Treatment:* A large proportion of the women die in labor. If the deformity is diagnosed and the distance from the nearest lumbar vertebra to the symphysis—the false or effective conjugate—is $3\frac{1}{8}$ inches (7.93 cm.), the forceps can deliver the child. If less, a suprapubic operation must be done.

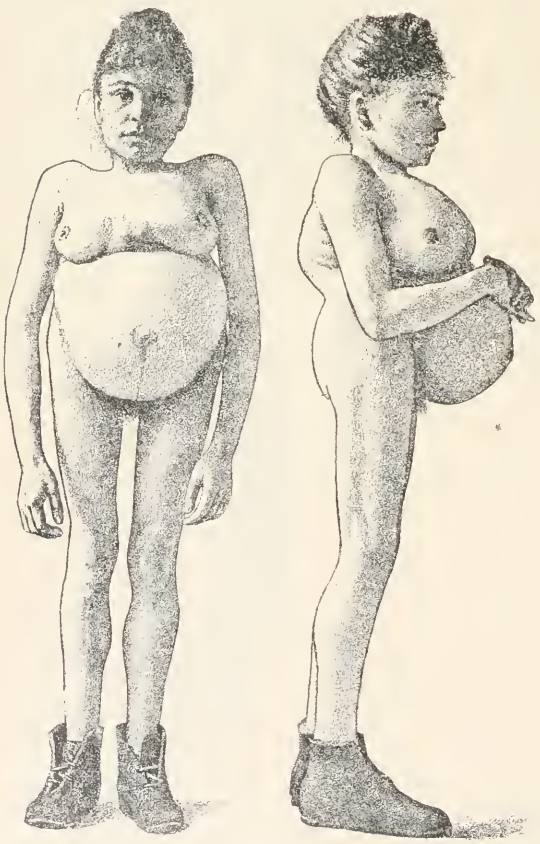

FIG. 861 AND FIG. 862.—DORSO-LUMBAR KYPHOSIS. —(*Tarnier.*)

Spondylolizema.—The condition known as spondylolizema is analogous to the one just described, although it is not congenital but results from caries of the last lumbar vertebra. The name *pelvis obtecta* is applied to this deformity as well as to the extreme rachitic pelvis.

II. Kyphosis,* Kyphotic Pelvis (Figs. 863 to 866).—Breisky gave the first complete description of this pelvis in 1865, although the condition had been previously recognized by Litzmann and Neugebauer. *Frequency and etiology:* Although this form of pelvis is comparatively rare, still an accurate observer in the course of his practice will undoubtedly meet with examples. The deformity results from kyphosis or from

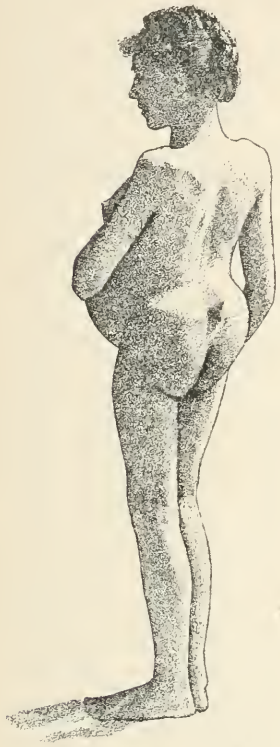

FIG. 863.—SACRO-LUMBAR KYPHOSIS.

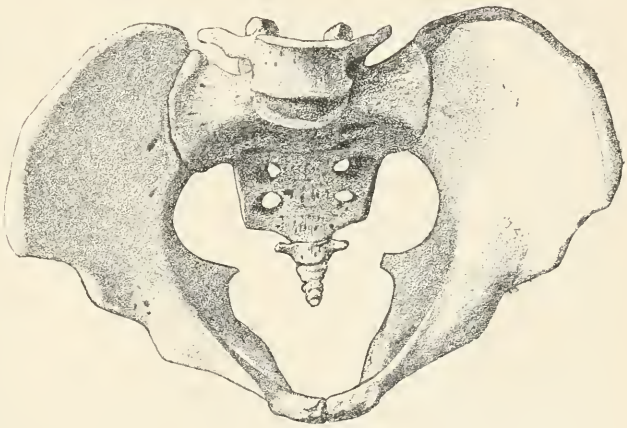

FIG. 864.—KYPHOTIC PELVIS SHOWING THE ILIAC FOSSÆ AND PELVIC INLET.

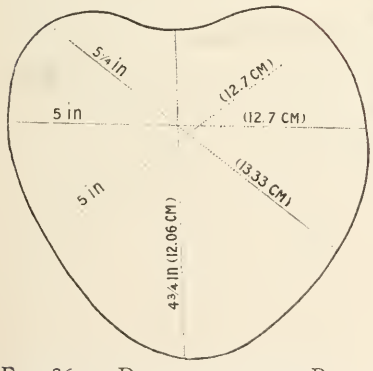

FIG. 865.—DIAGRAM OF THE PELVIC INLET OF FIG. 864.

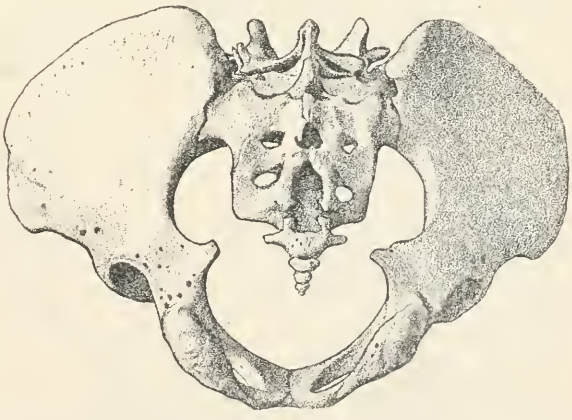

FIG. 866.—KYPHOTIC PELVIS SHOWING THE PELVIC OUTLET.

Pott's disease, which affects the spine at such a low point that the usual lordosis which is present as a compensatory factor cannot overcome the faulty direction

* *Kyphosis.* Hump-backed. Angular curvature and dorsal prominence of the spine. Backward curvature of the spinal column.

FIG. 867.—PREGNANCY WITH A KYPHOTIC PELVIS. HANGING BELLY.—(*Tarnier.*)

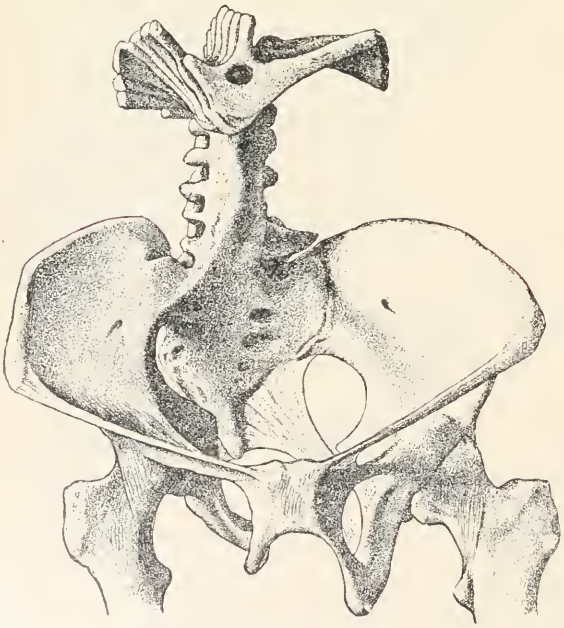

FIG. 868.—OVAL OBLIQUE KYPHOTIC PELVIS.—(*Guichard.*)

of the force of the body-weight. *Clinical characteristics:* Naturally the extent of the deformity will depend on the position of the spinal protuberance (Figs. 862, 863, 867). The lower this is, the worse will be the resulting deformity. The most common position for the kyphosis is at the junction of the dorsal and lumbar vertebræ. As the result of the insufficient compensation of the lordosis of the lumbar spine, the rotation of the sacrum on its transverse axis is downward and backward, just opposite to that seen in rachitis. The body is bent forward, and the pelvic inclination diminished (Fig. 867). The sacrum is higher, straighter, longer; its lateral concavity is increased so that its width is lessened (Fig. 870). The conjugate of the inlet is increased. The anterior spines of the iliac bones are pushed further apart, while the posterior spines are more closely approximated, this latter effect being the result partly of the pull exerted by the sacro-iliac ligaments and partly of the narrowness of the sacrum. The width of the pelvis is decreased through its whole depth, most markedly so at the outlet on account of the approximation of the spines of the ischia. The coccyx and the end of the sacrum are pushed forward, thus decreasing the pelvic outlet. The narrower this outlet becomes, the wider the inlet, for the outward force exerted on the iliac crests is increased, this effect being heightened by the extra strain on the ilio-femoral ligaments which pull the anterior inferior spines downward and

outward. In order that the body may not fall forward, there occurs a slight flexion of the knees and thighs, while there is scarcely any pelvic inclination (Fig. 862). When the deformity is lumbo-sacral there may be involvement of the superior part of the sacrum in the pathological process and its tissues may be destroyed (Fig. 863). The promontory of the sacrum is palpated with difficulty per vaginam. *Diagnosis:* The history of the case is generally plain, and the deformity very evident. As in all cases of pelvic deformity, the measurements are most valuable. They show that the anterior spines and crests of the ilia are more widely separated, while the posterior spines as well as the ischial tuberosities are approximated. The conjugate of the outlet is to some extent decreased. Complications such as asymmetry, general contraction from arrested development, and lateral contraction at the inlet should always be guarded against, as they often make spontaneous labor impossible. *Prognosis:* Winckel states that in a series of twenty-one cases of this kind the maternal mortality was 66 per cent., while that of the children was 75 per cent. Labor is much obstructed by the prominence of the lumbar spine in all cases except in those with the least marked lumbo-sacral kyphosis. The untoward effects are not generally pronounced until the presenting part has reached the pelvic floor (Fig. 869). The tendency to shoulder presentation on account of the decreased perpendicular diameter of the abdominal acvity is generally corrected by the first few labor pains. The labor may be more precipitate than normal, but when the presenting part reaches the outlet the obstruction may be so great that there can be no spontaneous advance, though now and then labor is terminated spontaneously on account of the great mobility of the pelvic joints. Occipito-posterior positions are quite common in these pelves, since on account of the posterior deformity of the sacrum more room is offered for the fetal back. *Treatment:* As a rule, labor is not difficult to manage.

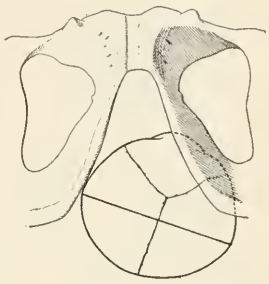

FIG. 869.—ESCAPE OF THE HEAD UNDER THE PUBIC ARCH IN A KYPHOTIC PELVIS.—(*Tarnier.*)

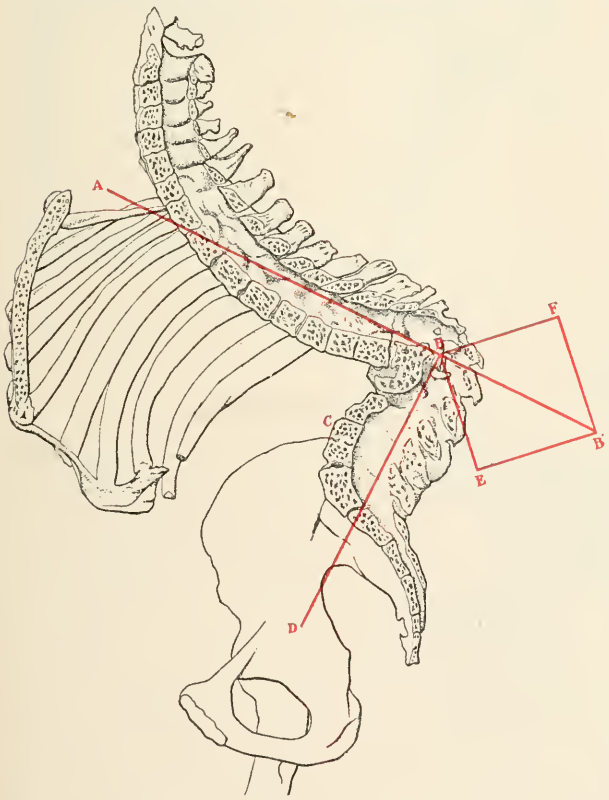

FIG. 870.—DIAGRAM SHOWING THE FORCES CONCERNED IN THE PRODUCTION OF A KYPHOTIC PELVIS.—(*Tarnier.*)

The forceps may afford sufficient aid for delivery; should the case be of a grave order, symphyseotomy will nearly always suffice. If, however, there is present an

FIG. 871.—SCOLIOSIS. POSTERIOR VIEW.

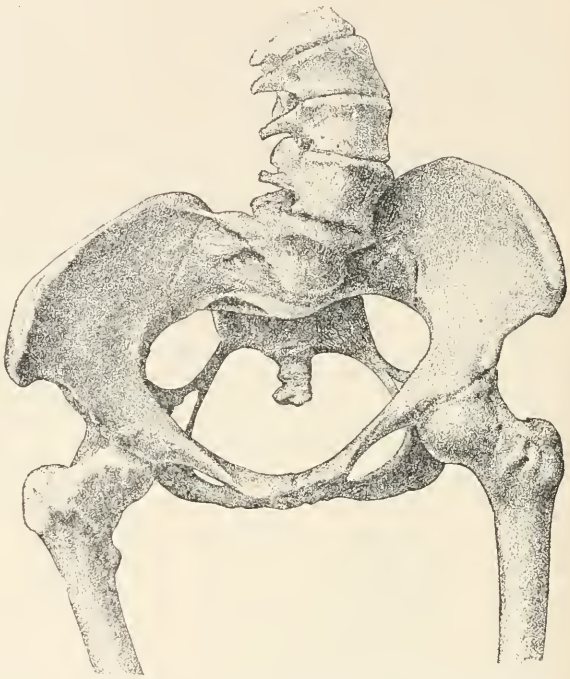

FIG. 872.—SCOLIOTIC PELVIS, WITH ENCROACHMENT OF THE LEFT COTYLOID REGION UPON THE PELVIC CAVITY.

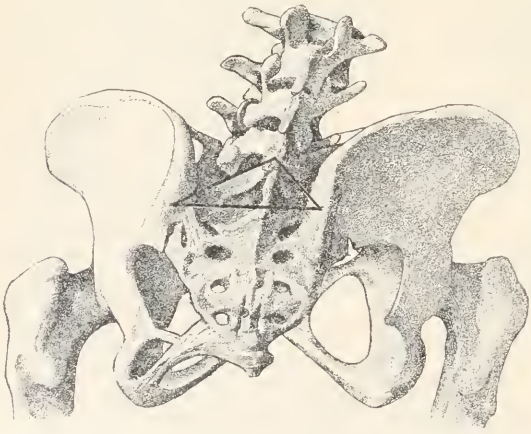

FIG. 873.—SCOLIOTIC PELVIS. POSTERIOR VIEW.

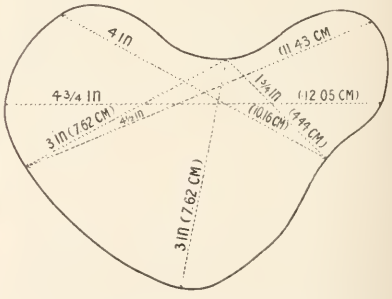

FIG. 874.—DIAGRAM OF THE PELVIC INLET OF FIG. 872.

asymmetrical or extreme contraction, it may be necessary to resort to Cæsarean section. In case of a dead fetus, craniotomy may easily be performed, since the head on the pelvic floor is quite accessible.

III. Scoliosis.* **Scoliotic Pelvis** (Figs. 871–874).—This term includes all the lateral deformities of the spinal column having a pathological origin. *Frequency and etiology:* This is a rare form of pelvic deformity. The most frequent cause is rachitis, consequently the pelvis may be contracted as well as asymmetrical. The origin, however, may be non-rachitic. The deformity, as a rule, begins during the development of the pelvis, the result depending on whether this is before or after ossification of the pelvic bones. *Clinical characteristics:* The deformity of the pelvis is marked and the degree of scoliosis is quite perceptible. The two sacrocotyloid diameters are not of equal length, while the internal conjugate does not come up to the normal. Deformities of the pelvis are not so marked as they would be, if every convexity did not usually have its compensatory concavity. In the pelvis with this deformity there is a certain amount of oblique contraction. The lumbar vertebræ are the ones generally affected. The superior articulating sacral surface, on the side toward which the bending of the spine takes place, receives the greatest weight. The center of gravity is displaced. The head of the femur exerts a greater pressure upward, inward, and backward against the innominate bone of the deformed side. There is also an anterior upward displacement of the acetabulum on this side, while the symphysis is forced to the opposite side. The pelvis on the deformed side is diminished in size (Figs. 872, 873, 874). In case of the limitation of the scoliosis to the dorsal vertebræ, a compensatory bending of the lumbar vertebræ may hinder any change in the form of the pelvis from taking place. *Diagnosis:* The deformity may be detected by observation and pelvimetry. *Prognosis:* The asymmetry is seldom so marked as to cause serious obstruction to labor, the mechanism corresponding with that in the generally contracted pelvis. If delivery is possible, the forceps is indicated after the head has become well moulded.

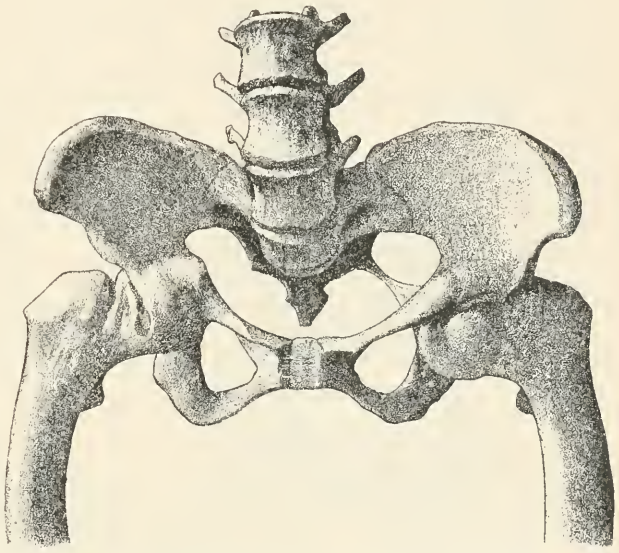

FIG. 875.—SCOLIO-RACHITIC PELVIS, WITH RENIFORM INLET. Encroachment of the right cotyloid region upon the pelvic cavity.

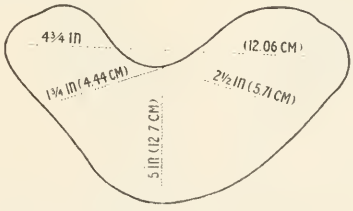

FIG. 876.—DIAGRAM OF THE PELVIC INLET OF FIG. 875.

IV. Kyphoscoliosis.† **Kyphoscoliotic Pelvis** (Fig. 878).—This deformity

* *Scoliosis:* Lateral curvature of the spinal column.

† *Kyphoscoliosis:* Backward and lateral curvature of the spinal column.

includes a combination of the malformations of kyphosis and scoliosis. It is an obliquely contracted pelvis of lesser degree, being mostly deformed in the transverse diameters. *Frequency and etiology:* The etiology is naturally that of the two types which make this combination. *Clinical characteristics:* The most common example of this type is the lumbo-dorsal kyphoscoliosis. The kyphotic deformity is primary in point of time, and, combined with the scoliosis, a combination of both sets of deformities results with a trace of the original funnel-shape. The pelvis is decidedly asymmetrical, though its lateral contraction is not so great as in a pure kyphosis. As the kyphosis is etiologically rachitic and not carious, it will not be angular, but it will be superior dorsal in position and will run the chance of being compensated for by lordosis of the lumbar region. The joints are all rachitic. The symphysis is inclined to the side opposite the direction of the lumbar curve. The spinal

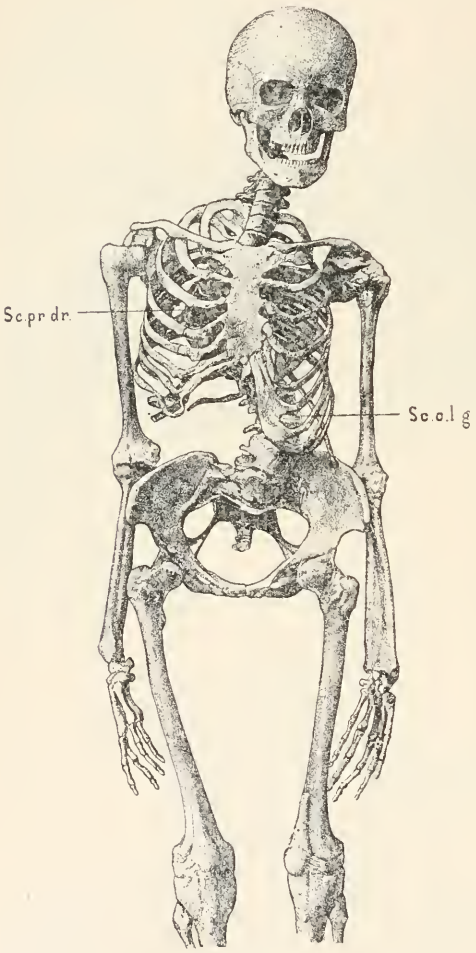

FIG. 877.—SCOLIO-RACHITIC SKELETON. *Sc.pr.dr.*, Primary dorsal scoliosis; *Sc.o.l.g.*, compensatory lumbar scoliosis.—(*Clamart.*)

FIG. 878.—KYPHOSCOLIOTIC SKELETON.—(*Leopold.*)

bones present the combined deformities of rachitis and kyphosis. Vaginal examination yields the same results as in kyphosis. The true conjugate is increased and the pelvis is transversely flattened and represents a lesser degree of obliquely contracted pelvis. *Diagnosis:* This will be made from observation of the deformity and from pelvic measurements. *Prognosis:* This will depend upon the degree of deformity.

V. Assimilation Pelvis.—This pelvis resembles the kyphotic type and is slightly funnel-shaped. The deformity depends upon the symmetrical blending of the five vertebræ of the coccyx with the lower sacral vertebra or of the upper sacral vertebra with the lower lumbar vertebra (Fig. 879). Single-sided asymmetry may depend upon scoliosis of the vertebræ of the coccyx. The deformity then resembles scoliosis and is more pronounced in the presence of rachitis. When the deformity is symmetrical, the promontory is high, the angle being but slightly developed, and the pelvic curve diminished by the slight forward bending of the trunk.

VI. Lordosis Pelvis.*—Neugebauer refers to some cases of primary lordosis independent of spinal disease or pelvic deformity, and in this country the only case described is that of Hirst (Fig. 880). It can readily be seen how a marked anterior spinal curvature would greatly increase the pelvic inclination, and thus interfere with the engagement of the presenting part.

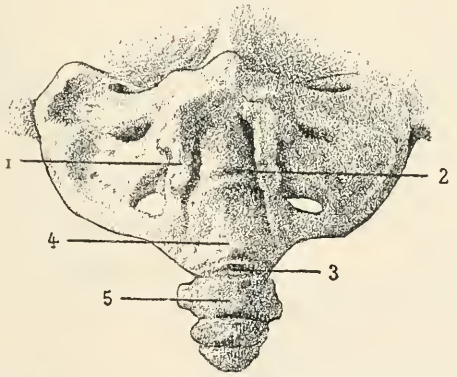

FIG. 879.—ASSIMILATION OF THE FIRST COCCYGEAL VERTEBRA WITH THE SACRUM. 1, Blending of the horns of the coccyx and sacrum; 2, blending of the bodies of the fifth sacral and first coccygeal; 3, movable intercoccygeal articulation; 4, assimilation of first coccygeal vertebra; 5, coccyx.

FIG. 880.—LORDOSIS FROM PARALYSIS OF THE SPINAL MUSCLES. —(*Hirst.*)

E. ANOMALIES OF THE PELVIS DUE TO DISEASE OF THE WEIGHT-BEARING PARTS OF THE SKELETON.

I. Coxitis. Coxalgic Pelvis (Fig. 883).—This deformity may be described as an oblique pelvis dependent upon hip disease. The coxalgic pelvis is subject to several modifications which depend upon the time at which the affection originates and the mobility of the diseased part as well as upon the presence of dislocation. The earlier this trouble begins and the more the leg is used, the greater will be the deformity. If the disease does not appear till after the pelvis

* *Lordosis*· Anterior curvature of the spinal column.

is developed, there may be an absence of obliquity. *Frequency and etiology:* The deformity is not infrequent. Other causes besides hip-disease are infantile paralysis, dislocation of the hip-joint, and amputation of a lower extremity. *Clinical characteristics:* There are two types of this pelvis, although there is obliquity in each case: (1) In the first type the innominate bone on the unaffected side is pushed upward, inward, and backward, since the sound leg carries the main body-weight (Fig. 881). Thus the sound side is contracted while the diseased side, lacking the normal developing forces, persists in its infantile form or the form it had when the disease manifested itself. The location of the deformity is just the reverse of that in the Naegele pelvis. (2) In the other type the deformity is on the diseased side, the innominate bone of this side being forced in upon the pelvis, the deformity depending upon the arrested development of this side (Fig. 882). There is probably a co-existent atrophy of the sacral ala with anchylosis of the sacro-iliac joint. There will be observed, therefore, an asymmetrical pelvis; rotation of the pelvis upon the spinal column; anchylosis of the hip and decided shortening of the conjugate.

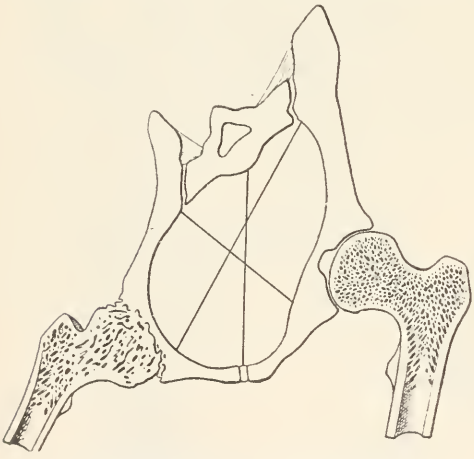

FIG. 881.—COXALGIC PELVIS SHOWING DEFORMITY ON THE HEALTHY SIDE.

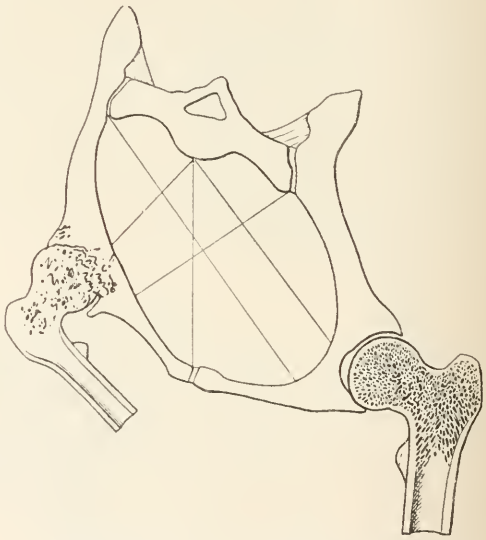

FIG. 882.—COXALGIC PELVIS SHOWING DEFORMITY ON THE DISEASED SIDE.

Diagnosis: These patients are recognized by their limp. Pelvimetry as well as palpation, both external and internal, will reveal the state of affairs in the pelvis. *Prognosis:* The degree of deformity is seldom so great as to interfere seriously with labor. In such a case the method of procedure would correspond with that advised for the Naegele pelvis. In the first type there is seldom any serious obstruction to labor unless rachitis is also a complication. It is in the second type that difficulty is experienced, and it may be as great as in the Naegele form.

II. Luxation of the Head of One Femur (Figs. 885, 886).—If this deformity is congenital or if it take place in early years, the pelvis is somewhat affected, but not, as a rule, to such an extent as to affect labor seriously. The resulting shape of the pelvis will depend upon the direction in which the luxation takes place. An oblique contraction may be produced by a one-sided dislocation.

III. Luxation of the Heads of Both Femora (Figs. 887, 888, 889, 890).—The general statements made in the last paragraph will also apply to this case. If

both thigh-bones are dislocated backward upon the ilia, the sacrum is rotated forward to an extreme degree, and the canal of the pelvis becomes shallow with a very wide outlet. The line between the lower border of the symphysis and the inner femoral condyle is diminished.

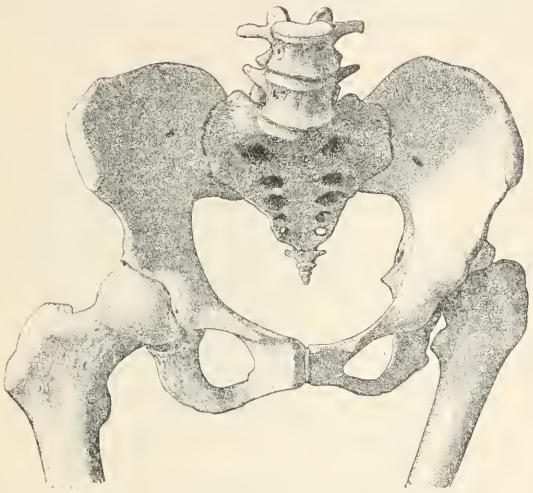

FIG. 883.—COXALGIC PELVIS WITH ADDUCTION OF THE DISEASED FEMUR (LEFT SIDE).

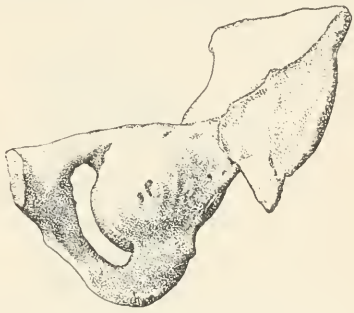

FIG. 884.—ENLARGEMENT OF THE COTYLOID REGION DUE TO COXALGIA.

IV. Unilateral or Bilateral Club-foot (Fig. 891).—These deformities produce changes of little importance. The inclination of the pelvis is increased, the arch of the pubis is narrowed, the tuberosities of the ischia and the acetabula are brought closer together.

V. Absence or Deformity of One or Both Lower Extremities.—In the first case there results the "Sitz pelvis," the characteristics of which have already been noted (page 622). Generally there is rotation of the

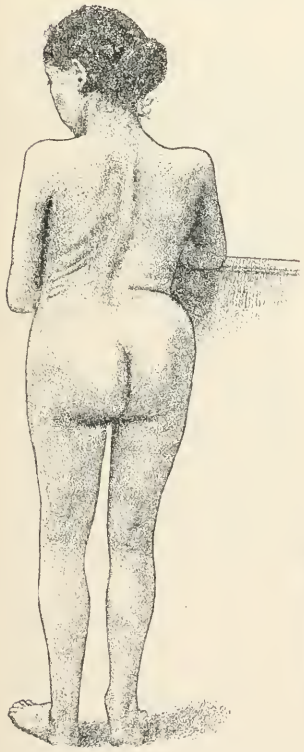

FIG. 885.—DISLOCATION OF THE RIGHT FEMUR.

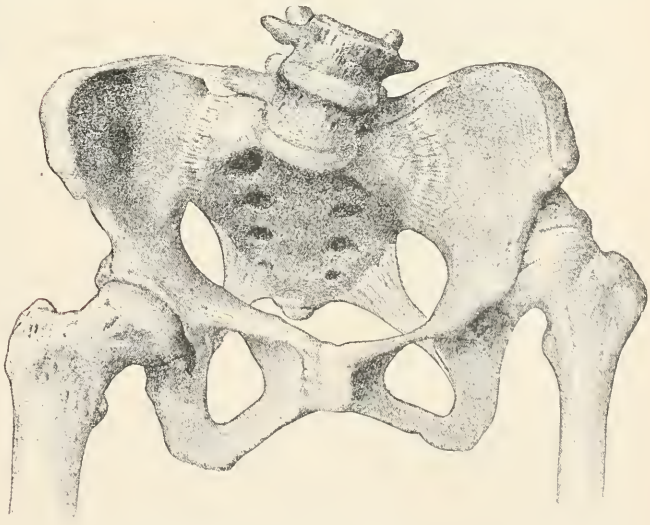

FIG. 886.—DEFORMED PELVIS FROM CONGENITAL DISLOCATION OF ONE FEMUR (LEFT SIDE).

innominate bones on an anteroposterior axis, so that the iliac crests approach each other, while the ischial tuberosities are separated. Any deformity occurring in consequence of the bowing of the extremities is scarcely worth the mention from a practical standpoint.

GENERAL SYMPTOMATOLOGY.

Subjective Symptoms.—*In pregnancy:* The effects of deformed pelves are various. They may alter the position of the pregnant uterus; *e. g.*, in contraction

FIG. 887.—CONGENITAL DISLOCATION OF BOTH FEMURS.

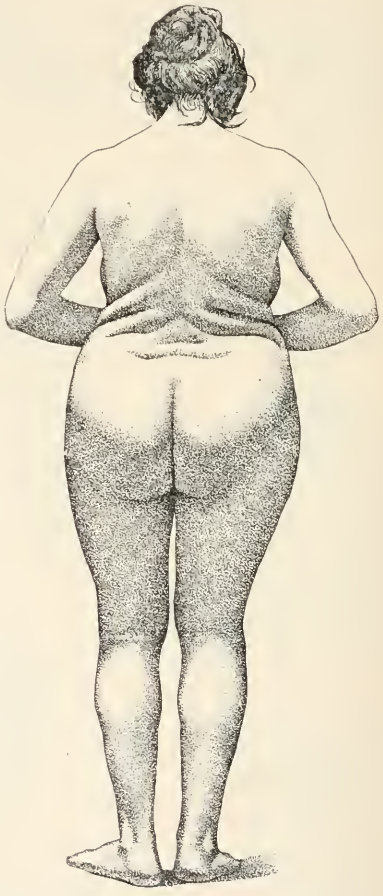

FIG. 888.—CONGENITAL DISLOCATION OF BOTH FEMURS.

of the pelvic inlet in the early months, the uterus may become retroverted, and even finally incarcerated in the pelvis. Later the uterus is higher than in normal gestation, since the head of the fetus cannot descend into the pelvis. In the later months of pregnancy the uterus is far more mobile than normal on account of the narrowing of the pelvis. Its obliquity is also increased. The patient is frequently unable to empty the bladder owing to the pressure to which it is

subjected. Quickening is felt early, generally by the fourth month. Pendulous abdomen is very common in contracted pelvis from the position of the long axis of the uterus, which looks either forward or to the right, and is especially marked in patients whose abdominal walls are flaccid. It is more frequently found in multigravidæ than in primigravidæ. If pendulous abdomen is not a complication, the fundus will be much higher in position than normal. *In labor:* The pains are very irregular and their nature depends upon the abnormal fac-

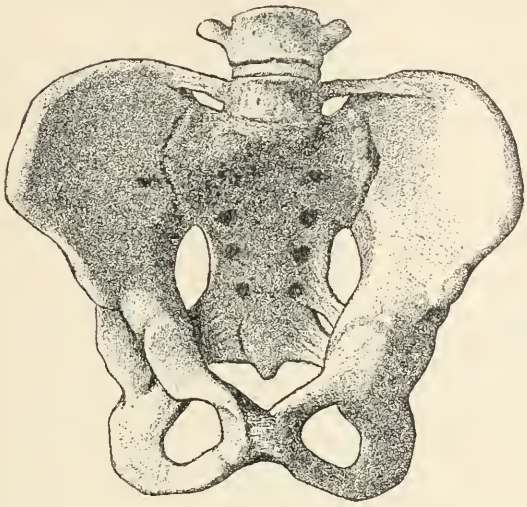

FIG. 889.—PELVIS FROM A CASE OF CONGENITAL DISLOCATION OF BOTH FEMURS.

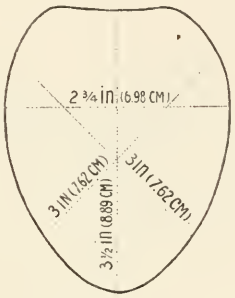

FIG. 890.—DIAGRAM OF THE PELVIC INLET OF FIG. 889.

tors producing them. They are sometimes violent, at other times spasmodic, and again they are feeble. Labor is prolonged. When labor is beginning, the presenting part is abnormally high and does not adapt itself well to the lower uterine segment. The head is very slow in engaging, consequently in pregnancy lightening does not occur, and these conditions give rise to painful dyspnea. Sometimes the presenting part fails to engage at all. The caput succedaneum is generally very large and its gradual development is sometimes thought to indicate progress of the descending part. The presentation and position of the fetus also often suffer from contracted pelves, the abnormal varieties being about three times as common as normal. For example, a vertex presentation may be turned into a brow, face, or shoulder. In breech presentation there is frequently a prolapse of foot or knee. Prolapse of the cord is also frequent. Multiparity, as in the normal pelvis, only adds to the likelihood of faulty presentations, for the walls of both uterus and abdomen became gradually more relaxed with each successive pregnancy. If the uterus together with the cervix is either at or above the pelvic inlet, the bag of waters is forced downward into the cervix as a conical body. Not infre-

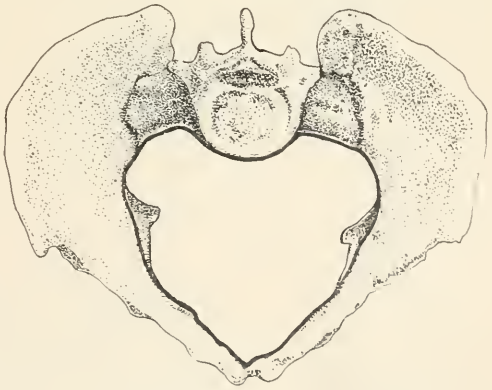

FIG. 891.—DEFORMED PELVIS FROM DOUBLE CLUB-FOOT.

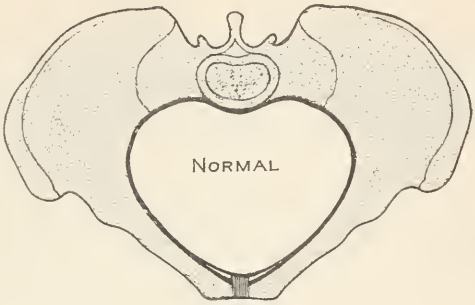

FIG. 892.

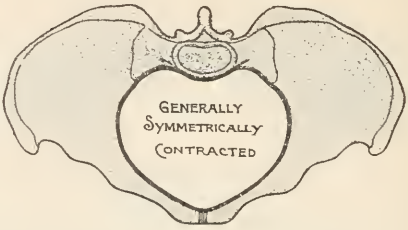

FIG. 893.

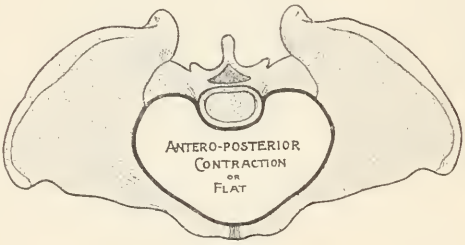

FIG. 894.

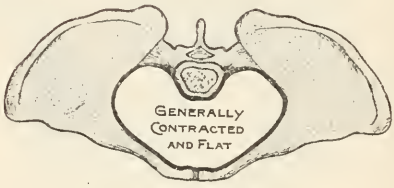

FIG. 895.

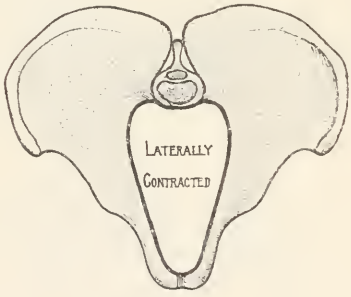

FIG. 896.

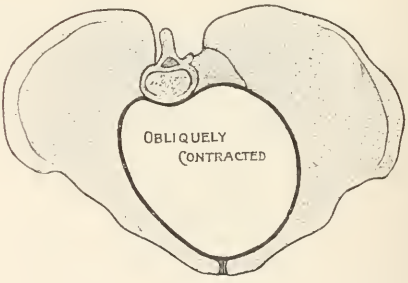

FIG. 897.

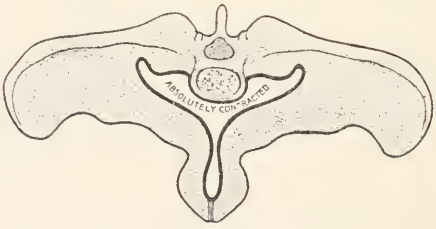

FIG. 898.

FIGS. 892 TO 898.—SHAPE OF THE PELVIC INLET IN THE MORE COMMON TYPES OF PELVIC DEFORMITY, COMPARED WITH THE NORMAL.

quently the membranes rupture early with escape of the liquor amnii. The lower uterine segment may become so stretched and thin that it bursts, while the rupture may involve the cervix and vagina or there may occur a forcible separation

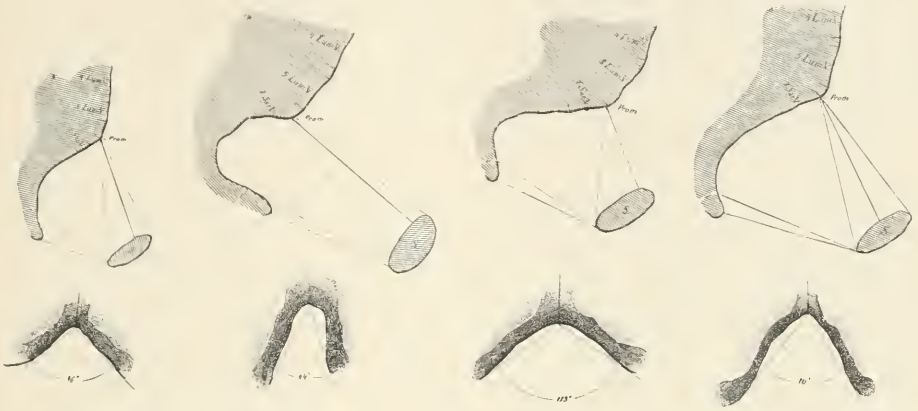

FIG. 899.—CONGENITAL DISLOCATION OF BOTH FEMURS.

FIG. 900.—OSTEOMALACIA.

FIG. 901.—RACHITIS. RELATIVELY CONTRACTED.

FIG. 902.—OVAL OBLIQUE PELVIS.

FIGS. 899 TO 902.—THE AUTHOR'S LEAD-TAPE TRACINGS OF VARIOUS TYPES OF PELVIC DEFORMITY, SHOWING SAGITTAL SECTIONS AND SHAPES OF THE PUBIC ARCHES OF EACH.

of the uterus from the vagina. In any case the maternal soft parts are apt to be bruised and lacerated; so much so, indeed, that sloughing will often follow.

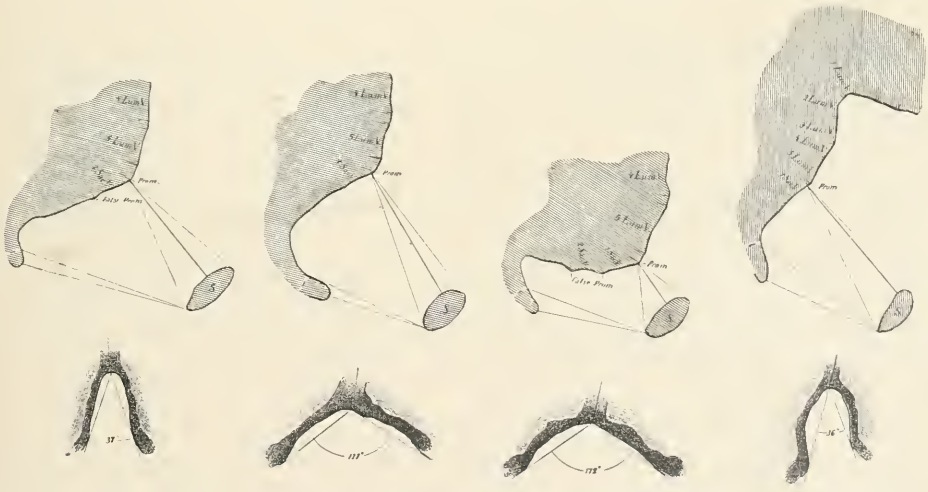

FIG. 903.—DOUBLE OBLIQUE PELVIS.

FIG. 904.—SPONTANEOUS DISLOCATION OF ONE FEMUR.

FIG. 905.—RACHITIS. ABSOLUTELY CONTRACTED.

FIG. 906.—OVAL OBLIQUE KYPHOTIC PELVIS.

FIGS. 903 TO 906.—THE AUTHOR'S LEAD-TAPE TRACINGS OF VARIOUS TYPES OF PELVIC DEFORMITY, SHOWING SAGITTAL SECTIONS AND SHAPES OF THE PUBIC ARCHES OF EACH.

Œdema is also a complication. The articulations are in certain cases separated by the force exerted for the delivery of the child.

Objective Symptoms.—(See General Diagnosis, below.) (Figs. 892 to 906.)

GENERAL DIAGNOSIS.

Previous History.—The previous history will often furnish essential information concerning the present condition of the pelvis. If traces of rachitis, for example, are seen in other parts of the body, there will be strong presumptive evidence as to the presence of a rachitic pelvis. The history of previous labors will offer a probable prognosis as to the termination of pregnancy. The characteristic influences of the various diseases have been enumerated.

Inspection.—Account should be taken of the posture of the woman, of spinal curvature, and of any lameness.

Palpation.—The position of the hips, the size of the iliac bones, the depths of the iliac fossæ, the width and curve of the sacrum, and the depth, thickness, and inclination of the symphysis should be noted (Figs. 892 to 906).

Mensuration. Pelvimetry.—The physician should measure the pelvis as a routine in the examination of pregnancy (see page 148) and in cases of suspected maternal or fetal obstruction, for the same reason that he uses percussion and auscultation in the diagnosis of cardiac and pulmonary disease. Although the science of pelvimetry is most important, still the child's birth depends partly on the size of its head, the degree of its adaptability, the character of the uterine contractions, and the resistance of the maternal perineum and soft parts. It also happens that in two patients with the same size pelves one can be delivered spontaneously while the other cannot. However, these facts do not lessen the obstetrician's duty in respect to pelvimetry; they merely indicate its limitations. (Compare clinical characteristics of various forms of pelvic deformity, pages 619 to 653.)

Prognosis.—(See Individual Varieties and Treatment.)

PROPHYLACTIC TREATMENT.

Prophylaxis may be instituted at various stages in the history of the mother.

In case of the grosser pelvic deformities, *seen before marriage*, in which birth by the natural passages would be impossible, one would be justified in advising celibacy.

If a woman with a pelvis which will not permit the birth of a viable child is *already married*, or if the pelvis of a newly married woman is contracted to a questionable degree and the husband is of another race, or much larger than his wife, or has head measurements unlike hers, it may be advisable to avoid conception. In any case the choice must lie between foregoing offspring altogether and conception with some expedient for avoiding labor at full term. If the woman conceives deliberately, much care should be used in determining as accurately as possible the date of the fecundating coitus. The subject of avoidance of conception has been considered on page 37.

In cases of absolute contraction seen *after conception has occurred*, much would depend upon the month of gestation at which the advice of the physician is sought. If the pregnancy is recent and the pelvis such that natural delivery would be impossible, the alternative is between artificial abortion and Cæsarean section at term. In this situation the burden of choice should be placed on the woman and her relatives. If Cæsarean section is absolutely refused, pregnancy may be interrupted—the sooner the better. In anything short of absolute pelvic contraction, artificial abortion would not be justifiable. If the pregnancy were far advanced in absolute pelvic stenosis, little or nothing would be gained by the induction of premature labor in comparison with Cæsarean section. In instances of relative contraction, the patient, whatever the stage of pregnancy,

may look forward to a twofold alternative: (1) Artificial premature delivery; (2) delivery at full term with dependence upon Prochownik's diet to keep down the size of the fetal head. (1) *Artificial premature labor:* This is a preventive of dystocia, the only objection being the danger of fetal death from immaturity. As to the mother, the danger is undoubtedly greater in dystocic delivery than in induced labor. (2) *Diet:* The principle of regulating the diet of the pregnant woman for the purpose of preventing overgrowth or retarding full development on the part of the fetus, and thereby favoring eutocia, has been carried out in a limited way for a number of generations; yet this topic is hardly mentioned in the great majority of text-books.

Prochownik's attention was called to the subject by the mortality among children born before term, especially in connection with induced labor for contracted pelvis; and by his special experience in dieting pregnant women who were obese, anemic, etc., with the sole aim of improving the mother. In this connection he found that the nutrition of the fetus was modified in a twofold manner: first the embryo was enough of a true parasite to obtain nutriment to fulfil all the practical ends of healthy metabolism, growth, and vitality; second, the restriction in the mother's diet could manifest itself in the child in such particulars as a lessened accumulation of adipose tissue, and a slower rate of precipitation of the earthy matter required for ossification. Observations of this character have been reduced to a common truth in biology and the application of the diet to women with contracted pelves as a substitute procedure for artificially induced premature labor was a consistent and logical advance in the management of obstructive maternal dystocia. One of the first problems in imposing this diet upon the pregnant woman is to cut down the amount of fluids without the collateral provocation of constant thirst. To this end fats and carbohydrates are eliminated as far as possible and such articles are allowed as contain a large quantity of water, especially green vegetables. The diet * as originally published appears to have stood the test of experience without the necessity of subsequent modification. It is as follows:

Breakfast.—A small cup of black coffee, 3.38 oz. (100 c.c.); zwieback, or bread with a little butter, 4 or 5 oz. (25 grams).

Luncheon.—Any kind of meat or fish, eggs, green vegetables, salad, cheese.

Dinner.—Same as luncheon, with the addition of bread and butter 1 to 1¾ oz. (40 to 50 grams).

Absolutely Forbidden.—Water, soup, potatoes, farinaceous food, sugar, beer.

Fluids allowed: 10 to 14 oz. (300 to 400 c.c.) red or Moselle wine or water per diem.

Prochownik has now employed this diet for the past twelve years, the total number of births aggregating 26, while other obstetricians, especially in the Netherlands, have brought the total up to 62.

An analysis of the material which is tabulated by Prochownik in the "Therapeutische Monatschrift," August and September, 1901, appears to establish the truth of the following: (1) All the mothers bore the diet well after slight initial hardships, principally thirst (especially in the corpulent), and repugnance to so much animal food. Both these difficulties were mitigated by increasing the allowance of green vegetables. The weight of the woman, allowance being made for the growth of the embryo and uterus, remained practically at a standstill. (2) All the confinements were relatively easy in comparison with previous labors, even in those exceptional cases in which despite the diet the fetus was large and fat at birth. (3) All the children were born alive, although the mothers, as a class, had experienced still-births. The few cases of asphyxia neonatorum were easily reanimated. As far as known, all the children survived the accidents which produce secondary mortality. (4) The great majority of the children were lean at birth, there being a notable subdevelopment of the panniculus adiposus. The skin of the head was noticeably lax and the cranial bones exhibited a notable degree of mobility upon one another. (5) The children exhibited

* "Centralbl. f. Gynäk.," 1889, No. 33.

the essential insignia of maturity (normal length, head measurements, etc.). (6) The normal gain in weight took place in the majority of the children. (7) The diet of the mother exerted no unfavorable influence upon lactation.

Naturally, as soon as delivery occurs the special diet is discontinued and the substitute regimen is rich in non-nitrogenous articles. In all attempts at imposing an antidystocic diet upon a pregnant woman the regimen is not to be begun until the latter months of pregnancy. The Prochownik regimen is intended for the last six weeks of gestation only. It is believed that no extra advantage would accrue from lengthening the dietetic period. The large proportion of nitrogenous food and the small quantities of fluid of Prochownik's diet undoubtedly favor the toxemia of pregnancy. I was confronted with this difficulty in a relative generally contracted pelvis, and in spite of the free exhibition of calomel and colon irrigation was compelled to abandon the diet, and to induce labor at the thirty-eighth week.

CURATIVE TREATMENT.

The problem of the proper management of labor in contracted pelves is one of the most difficult in midwifery. The subject itself is a vast one, for it concerns not only those cases in which the pelvis has been measured and the pelvic anomaly diagnosticated, but that greater contingent in which no exact pelvic diagnosis is made and which simply represents obstructive dystocia from some cephalo-pelvic disproportion which is generally of maternal origin. Broadly speaking, these labors can be managed in three ways: (1) Pregnancy may be interrupted before the fetus has attained a certain size (Part X). (2) Labor at term may be managed along normal lines; *i. e.*, may be left to nature until some complication arises which threatens the lives of mother and fetus. (3) Some form of active intervention, undertaken for the purpose of protecting the mother and child from the risks of dystocia, may be practised at or before the onset of labor—or forceps, symphyseotomy, embryotomy, or Cæsarean section.

It is a singular fact that *precedent and local prejudice* play highly important rôles in the choice of methods. Thus, in one obstetrical center perforation of the fetal cranium appears to be the commonest termination of these labors; in a second, the ideal is symphyseotomy; in a third, expectancy predominates; in a fourth, induction of premature labor. Those obstetricians who follow the national or local custom in the management of these cases naturally offer reasons for their conduct which appear sufficient for its justification. In many localities adherence to routine and precedent is responsible for unnecessary mortality and morbidity, either fetal or instrumental.

Some authorities who are not under the influence of custom are actuated largely by *theoretical considerations* in the management of these labors. Their theories may be the outgrowth of personal experience. Thus, an obstetrician who has seen spontaneous labor occur repeatedly in moderately contracted pelves without undue prolongation of the act of parturition comes to believe that such pelves up to a certain limit are not pathological at all. He therefore adopts a let-alone policy in the management of these cases. Another practitioner may have seen some accident—a rupture of the uterus, perhaps—occur in a pelvis with but a slight degree of narrowing. Thenceforth pelvic contraction is always something to be feared, and he forms a rule of terminating such pregnancies by the induction of premature labor or Cæsarean section.

Many obstetricians try to formulate indications for treatment based upon the *length of the true conjugate* as a clinical index of pelvic contraction and the particular species of pelvic deformity. But even if a uniform scale were agreed upon,

this method of fixing indications is trustworthy only to a certain extent; viz., in determining absolute pelvic contraction, or the degree which is prohibitive of delivery by natural passage at term. This * is represented in a flat pelvis by a true conjugate of less than 2.76 inches (7 cm.), and in a generally contracted pelvis by a true conjugate of less than 2.95 inches (7.5 cm.). Other obstetricians make the degree of absolute contraction slightly lower or higher, but the statistics of Krönig † show conclusively that a goodly proportion of labors may be spontaneous throughout, in any degree of pelvic narrowing which is outside the limit of absolute pelvic contraction. The same statistics show that interference may sometimes be indicated in the very mild degree of contraction. There is no criterion by which the obstetrican may foretell the outcome of a case. In something like 6 per cent. of cases of labor in contracted pelves, irrespective of the pelvic measurements, labor could not be completed without resort to Cæsarean section, symphyseotomy, or embryotomy. It is fair to assume that in this minority of cases there was either absence of proper pains or defective head moulding, and that these elements rather than a particular degree of pelvic contraction were chiefly responsible for the dystocia. In other words, given sufficient plasticity of the head and strong uterine contractions, relative contraction of the pelvis does not necessarily mean dystocia. In other words, the difference in the length of the true conjugate, up to a certain point, does not furnish a basis for special indications. Other factors are present in sufficient force to invalidate any system of procedure based upon several degrees of pelvic narrowing. A division into two degrees is well and good, for the indications in *absolute* and *relative* contraction differ widely; and although the subdivision of the relative contractions in two classes is not always satisfactory, it is most convenient and the best method we have for purposes of classification and clinical study.

CLASSIFICATION OF PELVIC CONTRACTION.

1. Absolute Pelvic Contraction.
   - Simple flat pelvis with a true conjugate of less than 2.76 inches (7 cm.)
   - Generally contracted pelvis with a true conjugate less than 2.95 inches (7.5 cm.)

2. Relative Pelvic Contraction.
   - Simple flat pelvis with a true conjugate of 2.76 inches (7 cm.) or more.
   - Generally contracted pelvis with a true conjugate of 2.95 inches (7.5 cm.) or more.
     - *Class One.—First Degree Contraction.*—Simple flat pelvis with a true conjugate from 3.74 inches (9.5 cm.) to 3.35 inches (8.5 cm.)
     - Generally contracted pelvis with a true conjugate from 4 inches (10 cm.) to 3.60 inches (9 cm.)
     - *Class Two.—Second Degree Contraction.*—Simple flat pelvis with a true conjugate of from 3.35 inches (8.5 cm.) to 2.75 inches (7 cm.)
     - Generally contracted pelvis with a true conjugate of from 3.50 inches (8.9 cm.) to 2.95 inches (7.5 cm.)

1. ABSOLUTE PELVIC CONTRACTION.

An absolutely contracted pelvis is represented in a simple flat pelvis by a true conjugate of less than 2.76 inches (7 cm.), and in a generally contracted pelvis by a true conjugate of less than 2.95 inches (7.5 cm.). If a woman with absolute pelvic contraction becomes pregnant, and is seen in season, she should be allowed to choose between therapeutic abortion and Cæsarean section at

* Krönig: "Die Therapie beim engen Becken," Leipzig, 1901. † Loc. cit.

term. If she be seen before the end of the seventh month it may be possible to induce labor and perform craniotomy.

In this situation, the burden of choice should be placed on the patient and her family; of other alternatives, it is not worth while to speak.

My experience with symphyseotomy would cause me to emphatically reject the claim of the Italian school that this operation has a place either in induced premature labor at or after the seventh month, or at the fortieth week in absolutely contracted pelves.

Again perforation and embryotomy are possible at term in the above cases, but I am satisfied that the mortality is greater than in Cæsarean section.

Some English authorities and J. W. Williams advise that if the true conjugate be above two inches (5 cm.) (absolute indication for Cæsarean section of some authorities), craniotomy should be the operation of choice when the fetus is dead or dying.

From this I strongly dissent, as my experience with craniotomy in these low grades of pelvic deformity has taught me that they carry with them a high degree of mortality to the mother. Moreover, unsuccessful attempts at craniotomy extraction and at embryotomy in pelves whose clinical index is between 2 and $2\frac{3}{4}$ inches, will greatly militate against the chances of the patient's recovery from a Cæsarean section that is subsequently necessary to deliver her.

2. RELATIVELY CONTRACTED PELVES.

A relatively contracted pelvis is represented in a simple flat pelvis by a true conjugate of 2.76 inches (7 cm.) or more and in a generally contracted pelvis by a true conjugate of 2.95 inches (7.5 cm.) or more.

Relative contraction of the pelvis does not necessarily cause dystocia. Thus, statistics show that a great majority of labors in all degrees of relatively contracted pelves may be termed physiological.*

*The Krönig statistics of the latter (loc. cit.) show that of 504 cases of labor in flattened pelves with a true conjugate between 3.74 and 2.76 inches (9.5 and 7 cm.), intervention for the pelvic complication alone was required in less than 9 per cent. (Below 2.76 inches—7 cm.—the percentage of intervention for the pelvic element was, of course, 100 per cent.) In the so-called second degree of contraction, 3.35 and 2.76 inches (8.5 and 7 cm.), the percentage of intervention for primiparæ was but 16, although much higher for multiparæ. For the so-called first degree of contraction, 3.74 and 3.35 inches (9.5 and 8.5 cm.), the percentage of intervention was but 2.7 per cent. In 222 cases of generally contracted pelvis with a true conjugate of from 3.94 to 2.95 inches (10 to 7.5 cm.) intervention for the pelvic element alone amounted to but 9 per cent. Below the measurement of 2.95 inches (7.5 cm.) (absolute contraction) the percentage of intervention was, of course, 100. In the second degree of contraction alone the percentage of intervention was 16 per cent., and in the first degree, zero In other words, in 91 per cent. of these relatively contracted pelves labor was of the normal type. In the great majority of cases no intervention whatever was required. In a small minority—14 per cent.—complications arose which menaced the life of the mother or child and necessitated the use of the forceps. These complications, however, had no connection with the pelvic deformity, at least so far as the mother was concerned, but arose from such conditions as fever, eclampsia, placenta prævia, etc. Indications to terminate labor proceeding from the state of the fetus may or may not have been due to the pelvic contraction. Doubtless there was a greater proportion of prolapse of the funis and intrauterine asphyxia than in labor in normal pelves, but the average duration of labor in these cases was less than fifteen hours, which is within normal limits. In the absence of good control material it is difficult to prove that the size of the pelvis is responsible for the fetal indications for forceps in Krönig's cases. The children were, as a rule, of large size in these forceps cases. Of the 64 cases in which it became advisable to interfere, 25 children were saved and 39 lost, the latter number including cases of fetal death *in utero*. The combined fetal mortality of the labors of "normal type" was 44, or about 10 per cent. This figure, however, is believed to represent the normal fetal death-rate including primary and secondary

In order to appreciate the fact that every case of labor in a pelvis relatively contracted is a law unto itself, and must be managed accordingly, one must study the phenomena and results of labors in which there has been no interference, namely, in which expectancy has been the main treatment. This has been done in recent years at the obstetrical clinics of Paris, Vienna, and especially Leipzig, where the work of Zweifel and Krönig is of great practical value.

They also demonstrate that even in the first degree of relative contraction spontaneous labor may be impossible. The outcome of a particular case is difficult to foretell. This is because of the difficulty of proving with accuracy the comparative size of the fetal head, and of predicting whether sufficient plasticity of the head and strong uterine contractions will be present in a given case. Both pelvimetry and cephalometry have, however, in the past few years made great strides toward accuracy, and we can to-day draw very definite conclusions by our different methods of examination concerning the relative size of a given pelvis and fetal head. (See Pelvimetry and Cephalometry, pages 162 to 180.)

Class One. First-degree Contraction.—*Simple flat pelvis with a true conjugate of from* 3.74 *inches* (9.5 *cm.*) *to* 3.35 *inches* (8.5 *cm.*).

Generally contracted pelves with a true conjugate of from 4 *inches* (10 *cm.*) *to* 3.60 *inches* (9 *cm.*).

Spontaneous labor is the rule in this class.

Krönig* in several hundred flattened pelves of this class found that the percentage of intervention was but 2.7 per cent.

Should there be an absence of proper uterine contractions or should defective head moulding or a large head be present, dystocia may ensue and failure of the head to engage in the pelvic inlet occur.

In Pregnancy.—If a case of first-degree contraction is seen in pregnancy before term, a careful estimate of the available space at the pelvic inlet should be made. For this purpose, I prefer internal manual pelvimetry and the use of the Farabeuf pelvimeter.

The fetal biparietal diameter at this time is also estimated by Perret's and Müller's methods.

Unless some special contraindication exists, the case may be allowed to go to full term. Prochownik's diet in the last six weeks will favor eutocia.

From week to week the relation between the size of the head and the inlet should be determined by Perret's method of cephalometry. If the head deeply engages in pregnancy, of course, all anxiety ceases.

The borderland cases of this class, with short conjugate, will render it difficult to predict the outcome of labor at term. Should cephalometry determine a disproportion between the biparietal and true conjugate diameters, then the indication of premature labor, according to the rules laid down for that operation in contracted pelves, should be considered.

In Labor.—Since spontaneous labor is the rule in these pelves of the first-degree contraction, labor should be allowed to proceed undisturbed as long as possible, and interfered with only for a positive indication.

Moulding engagement and descent usually occur after a reasonable period

mortality. Krönig and others who incline to the belief that labor in contracted pelves is physiological up to a certain point, admit that the size of the pelvis contributes to the death of the fetus in certain cases. But no control statistics of labor in normal pelves are published, and as the average duration of these labors is not beyond the normal, it is possible that this concession is not warranted by the facts. The proportion of forceps cases is not greater than in many miscellaneous series.

* Loc. cit.

of second-stage pains, provided sufficient plasticity of the head and strong uterine contractions are present.

The membranes should be undisturbed, and in delayed cervical dilatation, a careful bimanual stretching of the ring of the os I have found a valuable procedure.

Our aim is to secure engagement of the head, so as to avoid the resort to high forceps or version, if possible. To this end the Walcher position (Part X), used from time to time, will increase the pelvic inlet conjugate and assist in cephalic engagement.

The forceps, high, medium, or low, may be required in cases of prolonged second stage, and under the same conditions as in delayed second stage in general. The advice to perform version at the completion of the first stage, the *prophylactic version* of many German authorities, in all cases of moderately contracted pelves, I believe is rarely, if ever, called for, and by reason of the rapid extraction thus made necessary, is almost always fatal to the fetus.

The management of labor with relative contraction of the pelvis may be summed up as follows: Labor should be allowed to proceed and the character of the pains and the moulding of the head noted. In vicious presentations and positions it may be necessary, of course, to perform prophylactic version. If labor progresses satisfactorily, the case may be left to nature unless an indication arise to terminate it rapidly. If it becomes evident that labor is making no progress, the obstetrician must choose between forceps and version, symphyseotomy, Cæsarean section, and perforation.

Class Two. Second-degree Contraction.—*Simple flat pelvis with a true conjugate of from 3.35 inches (8.5 cm.) to 2.75 inches (7 cm.). Generally contracted pelvis with a true conjugate of from 3.50 inches (8.9 cm.) to 2.95 inches (7.5 cm.).*

When the true conjugate is over 2.76 inches (7 cm.) in flat and 2.95 inches (7.5 cm.) in generally contracted pelves, the possibility of the spontaneous birth of a full-term child of average size must be remembered. Although it is true that the larger sized pelves of this second-degree contraction may and do permit of spontaneous labor, still one must remember that the proportion of spontaneous births sharply diminishes as we recede from the limits of this degree and approach those of absolute pelvic contraction. (Less than 2.76 inches (7 cm.) in flat and 2.96 inches (7.5 cm.) in generally contracted pelves)

Thus Krönig found that in 504 cases of labor in flattened pelves with a true conjugate between 3.74 and 2.76 inches (9.5 and 7 cm.), relatively contracted pelves, intervention for the pelvic complication alone was required in less than 9 per cent., and below 2.76 inches (7 cm.) the percentage of intervention for the pelvic element was 100 per cent.

Krönig also found that in 222 cases of generally contracted pelves with a true conjugate of 3.94 to 2.95 inches (10 to 7.5 cm.), relatively contracted generally contracted pelves, intervention for the pelvic element alone amounted to but 9 per cent. Below 2.95 inches (7.5 cm.) intervention was necessary in 100 per cent.

On the other hand,* the statistics of Ludwig and Savar show that intervention was necessary with a true conjugate of

2.76	inches	(7 cm.)	in 100	per	cent.
2.96	"	(7.5 cm.)	" 85	"	"
3.12	"	(8 cm.)	" 75	"	"
3.35	"	(8.5 cm.)	" 50.3	"	"
3.50	"	(9 cm.)	" 41.3	"	"
3.75	"	(9.5 cm.)	" 24.4	"	"

* "Klin. Bericht über die Geburten beim Engen Becken, Bericht aus der II Geburt. Gynecol. Klinik in Wien," Wien, 1897, 120–353.

The treatment of this class must necessarily vary as the case is first seen in pregnancy or labor.

In Pregnancy.—The same general principles are in force here as in Class One. Careful watch for disproportion between the head and pelvic inlet should be kept with the aid of Ferret's and Müller's methods, assisted by nitrous oxide anesthesia, if necessary.

With the *lesser degrees of contraction* of this class, in the absence of marked disproportion, pregnancy may be permitted to proceed to full term, with the assistance in the last six weeks of Prochownik's diet. Should it appear at any time from the estimate of the size of the fetal head that serious dystosia is likely to ensue, the case should be treated as in the more marked degrees of this class.

In the *greater degrees of contraction* of this class we should never trust to spontaneous labor at term except in the case of twins or an exceptionally small fetus. The choice in these cases lies between induction of labor and Cæsarean section at or near term.

Excellent results in my cases have been obtained by inducing labor at the thirty-sixth week, and my fetal mortality from this procedure has been little if any greater than in spontaneous labor at term in normal pelves.

In balancing the choice between induction of premature labor and Cæsarean section, it must not be forgotten that although a small premature child does readily pass through a contracted pelvis when at full term decided dystocia would occur, still the premature fetus in less able to stand punishment either from birth, forceps, or other pressure.

For example, as I have frequently observed, an easy forceps or breech extraction at the thirty-fourth week is likely to be more dangerous to the child than a somewhat more difficult operation at full term.

At the thirty-sixth week the biparietal diameter is $3\frac{1}{4}$ inches (8.25 cm.), and although this does not correspond to the clinical index of all pelves of this class, still the greater plasticity of the fetal head at the thirty-sixth week permits of more ready moulding than at term.

The fetal mortality so progressively increases as we induce labor earlier than the thirty-sixth week, that in those cases of this class bordering upon absolute pelvic contraction the best prognosis for the child is obtained by Cæsarean section, and this should be the operation of choice in such instances.

In Labor.—In the lesser degrees of contraction of this class the same general principles obtain as in Class One.

In the cases bordering upon absolute contraction, interference will almost surely be required. Should a decided disproportion between head and inlet exist, or if after several hours of second-stage contractions the head has shown no tendency to engage and descend some, the likelihood of spontaneous delivery or of delivery by forceps or version is quite out of the question. The choice will now rest between Cæsarean section, symphyseotomy, and perforation. Version, in these cases, only adds to the dangers of the situation. It almost surely destroys the child, and the extraction gives a bad prognosis for the mother.

The forceps should only be used tentatively, for a short time, assisted by the Walcher posture, and never with great force or prolonged traction.

As in absolute contraction, Cæsarean section should here be the operation of choice, but with this exception, namely, only when the fetus is alive. This class of deformity will usually permit of craniotomy when the child is dead, and here, as in other forms of pelvic contraction, no sentimental or esthetic

reasons should ever prevent us from mutilating a dead fetus, when thereby we lessen the dangers to the mother.

My experience with and observation of many cases of symphyseotomy for pelvic contraction, does not permit me to recommend the operation as a competitor with Cæsarean section. The physician may be met with the refusal of the mother and her family to accept Cæsarean section.

Again, in sparsely-settled country districts, where assistance is not at hand, and in tenement-house practice, where a patient refuses to be removed to the hospital, the practitioner is occasionally compelled to sacrifice a living child.

In city practice, however, the physician can always refuse to perform embryotomy on a living fetus, as there are competent physicians at hand to whom the case can be transferred.

Again, if the patient when first seen already shows symptoms of infection by reason of a midwife's attendance, or repeated unsuccessful attempts at delivery, Cæsarean section should not be attempted by reason of the high maternal mortality in such cases.

In this last class, however, should the demands of the Catholic Church or a great degree of pelvic deformity demand Cæsarean section, a complete or incomplete hysterectomy should follow the operation.

Forceps and Version in Contracted Pelves.—To expectancy in the management of pelvic contraction, we may add, according to the indications, the forceps and version, the latter followed by immediate manual extraction.

Both the measures have often been sufficient to overcome considerable degrees of pelvic dystocia. The forceps is indicated in those cases in which the head is engaged or can be made to partially engage by suprapubic pressure, and in which our previous examination assures us there is no decided disproportion between the head and pelvic inlet. As a general rule, a tentative attempt to assist delivery by the careful use of the forceps should be made in all cases, before any more serious operation is undertaken. Excessive and prolonged traction with the forceps must not be made use of, as destruction of the fetus and possibly fatal results for the mother are quite likely to result.

At the Bellevue and Manhattan Maternity services undelivered women are frequently received, seriously torn and infected following prolonged and brutal attempts at forceps delivery.

It is a good plan, before doing any operation, to attempt to assist delivery by the means suggested for prolonged unobstructed labor (page 572) and by the Walcher position. Too much must not, however, be expected by this last manœuvre.

The forceps possesses the advantages of permitting a great degree of traction and a gradual extraction of the head. Its disadvantages are (1) that pressure over one diameter increases the length of the opposite; (2) the instrument occupies a certain space in the already small pelvis. Version has for its advantages: (1) the diameters of the head are not increased by a foreign body; the wedge-shape of the after-coming head adapts better to the inlet than the shape of the fore-coming head. Its disadvantages are: (1) no great force can be exerted upon the fetal body or neck; (2) rapid extraction, ten minutes at the longest, is necessary to secure a live child; (3) the complications of extension of the head and arms are always liable to occur, seriously affecting the prognosis.

Face, Brow, and Breech Presentations in Contracted Pelves.—*Face and brow presentations* always suggest pelvic deformity of some variety (p. 509), but not necessarily to a serious degree. In moderate degrees of pelvic contraction, the

treatment of face and brow presentations which I have suggested elsewhere (p. 517) is to be relied upon. In more marked deformity too much cannot be expected of the face or of the converted brow in the way of moulding and engagement, and radical measures for the safety of mother and fetus should be considered at the outset.

Breech presentation is rather unfavorable for the fetus, because of the delay in the moulding and engagement of the breech, in the likelihood of prolapse of the cord, and fatal asphyxia in the extraction of the aftercoming head. For the mother, unless the deformity is severe, a breech presentation is rather favorable, because of the less dangerous pressure caused by the buttocks of the fetus, and since extraction can usually be safely accomplished should occasion arise.

The prophylactic bringing down of a foot, soon after the rupture of the membranes, is a good plan in moderate relative contractions, to afford us a handle for subsequent extraction, should the latter become necessary.

MATERNAL DYSTOCIA FROM GENERAL MATERNAL CONDITIONS.

XXII. LABOR IN ELDERLY PRIMIPARAE.

Definition.—An elderly primipara is one who is thirty years of age and upward. Some authorities would even make twenty-eight years the boundary-line, while others regard thirty-two as the proper limit of youth.

Etiology.—The causes of late primiparity by no means coincide with late marriage. They are to be sought in part in uterine malpositions, metritis, cervical catarrh, tumors, congenital malformations, sexual frigidity, also in inability of the husband to procreate. The condition of the woman of which she is most conscious and which influences her against matrimony is contracted pelvis. When, as often happens, this is due to rickets or some skeletal deformity, she is not sought in marriage during the age at which men pay attention to externals in selecting brides. Sooner or later, too, these women learn something about contracted pelves, and therefore fear conception. The causes of the prolongation of these labors are described under "anatomical rigidity of the cervix" and "rigidity of the vagina, vulva, and perineum."

Symptoms.—After an elderly primipara conceives, her pregnancy and labor may exhibit certain peculiarities. Twin pregnancy appears from statistics to be common among these women. There is a higher proportion of malaise and gastric disturbance in the elderly. Kleinwächter thinks that the tendency to placental hemorrhages is less marked. The same author found a high percentage of renal mischief in those above thirty-five, while there is testimony from numerous sources that eclampsia is more frequent. In regard to the duration of labor, Courtade obtained an average of twenty-two hours and twenty-seven minutes. Nearly nineteen hours of this time was consumed in dilatation. As intervention was practised in a number of cases, the results, after eliminating the latter, showed about sixteen and a half hours for the entire labor, and fourteen and three-quarters hours for dilatation alone. After the further elimination of some premature cases, Courtade decides that the average duration of labor in the elderly is sixteen hours; his cases begin at the age of twenty-eight. Ahlfeld, with whom the age of elderly primiparity does not begin till thirty-two, finds the average duration of labor to be twenty-seven hours; while Kleinwächter makes the figure

eighteen hours. In 30 spontaneous labors after the thirtieth year I found the average duration of labor to be fifteen hours and forty-nine minutes. There are no known modifications of the third stage of these labors with the exceptions according to some, of a tendency to adhesion and retention of the placenta. As might be expected, lacerations of the birth tract are more common in the elderly, amounting to 30 per cent. Statistics readily show that the proportion of cases of operative interference increases with age: thus, from thirty to thirty-five, 13.6 per cent.; over thirty-five, 14.58 per cent.; jointly, 14.2 per cent. In regard to children, the tendency of the elderly primipara is to produce more boys than girls. The average weight of the newly born is, according to Mangiagalli and Kleinwächter, less than that of children of young primiparæ. The tendency to vicious presentation is greater with the advance of age of the primipara; I found 6 per cent. in 47 cases. Finally, the child mortality is said to be much higher. The figures range from 14.24 per cent. (Courtade) to 44.8 per cent. (Cohnstein). In my 47 cases the maternal and fetal mortality was *nil.* I append the private statistics of Courgenon, obtained from a study of all labors in women over thirty at the Clinique Tarnier, 1898–1899, as well as my own material.

In the Clinique Tarnier of Paris, of a total number of 111 cases, 81 ended spontaneously (73 per cent.) and the remainder were terminated with forceps. Post-partum hemorrhage occurred in 8 per cent. The average duration of labor was seventeen hours thirty minutes. There were about 5 per cent. of vicious presentations and 8 per cent. of pelvic deformity. Uterine inertia was present in 19 per cent. About 6 per cent. of women had albuminuria, but none developed eclampsia. There was one case of placenta prævia. The maternal mortality was less than 2 per cent., the fetal less than 4 per cent. In 2200 cases of labor I found the total number of elderly primiparæ to be 47, of which 30 ended spontaneously (63.8 per cent.); the remainder terminated with forceps. Four patients (8.5 per cent.) had post-partum hemorrhage. The average duration of spontaneous labor was fifteen hours forty-nine minutes. There were about 6 per cent. of vicious presentations and 25 per cent. of pelvic deformities. Uterine inertia was present in but 4 per cent.; if, however, we reckon the cases of post-partum hemorrhage under inertia, the percentage is nearly 13. There were no cases of placenta prævia. The maternal and the fetal mortality was each 0.

Conclusions.—The statistics of Courtade, of Courgenon of the Tarnier Clinic, and my own material appear to show that labor in elderly primiparæ is but slightly longer on the average than in primiparæ in general. Normal labor with first-born children is computed to last from twelve to fifteen hours (Tarnier). In the author's material the average duration was fifteen hours twenty-nine minutes—only some twenty minutes less than in the elderly alone. Hence the duration obtained by Ahlfeld and others (twenty-seven hours, twenty-five hours, etc.) cannot be attributed to mere age. Again, the low maternal and fetal mortality of the Tarnier Clinic and my cases show that the heavy mortality of certain statisticians (14.2 per cent., 44.8 per cent.) should be attributed neither to the age of the parturients nor to the instrumental intervention. The most, then, that can be said of the influence of age on primiparity is that it slightly prolongs the first stage of labor and somewhat increases the frequency of indications for the use of the forceps. The same conclusion is also reached by Courgenon. This is, of course, opposed to the tradition which prevails in both medical and lay circles and also appears to discredit the existence of what is known as "anatomical rigidity of the cervix," which is believed to be almost uniformly present in elderly primiparæ (page 606). Tarnier and Budin hold that the condition of absolute undilatable cervix, which sometimes gives way to circular rupture rather than yielding naturally, is excessively rare, and not to be confounded with the rigidity which is almost universally present in the primipara, and even in the multipara in premature labors. The coincidence of extreme anatomical rigidity in a few labors in elderly primiparæ might well beget the impression that such an association was inevitable, but, as has been shown, there is no sound basis for such an

opinion. What were the real causes of the extreme duration of labor and the high maternal and fetal mortality registered by competent observers in connection with primiparity after thirty years of age? Possibly the mothers were influenced unfavorably by the belief in the fatal issue of such labors. The problem is an important one, for in an era of late marriage and low birth-rate many women avoid maternity on the ground that they are too old for bearing children without great hazard to themselves. It is known that for some reason late breeders possess a higher proportion of pelvic deformity than younger women. I found 25 per cent. of pelvic deformity in my 47 cases of elderly primiparity.

XXIII. INTESTINAL HERNIA. VAGINAL HERNIA.

The ordinary forms of hernia—inguinal, crural, and umbilical—can hardly be ranked among causes of maternal dystocia. On the other hand, there is a special type of hernia—namely, the vaginal—which should be enumerated among such causes. Here the usual course of the prolapsed intestine is to occupy Douglas's pouch, although in rare instances it may descend in front of the uterus. The gut may remain in Douglas's cul-de-sac or descend between the vagina and the rectum. In the latter case it may appear at the perineum or in one of the labia majora. For vaginal hernia to occur, some anomaly of form of Douglas's cul-de-sac should furnish a predisposition. Such anomalies may be produced by a prolapse or retroversion of the uterus which tends to stretch the retrouterine ligaments. The accident, essentially rare, occurs much more frequently in the multiparous. Vaginal hernia may consist of both intestine and omentum. In the rare anterior form the hernia may comprise part of the bladder. These hernias seldom cause symptoms during gestation. In a few rare instances the size of the mass has been known to cause obstructive phenomena affecting the rectum and bladder. In a few cases rupture of the sac has been known to occur before delivery. From the standpoint of dystocia, vaginal hernia, if large, offers some hindrance to the descent of the head; but the danger concerns the mother principally, since the prolonged compression of the hernia may terminate in strangulation and necrosis of the gut. *Diagnosis* should be easy. If in the course of digital examination the finger encounters a bulging, elastic mass in the posterior cul-de-sac, and if this tumor is reducible, there can be little doubt as to its nature. Nevertheless, vaginal hernia has been mistaken for a great number of conditions, including the bag of waters, rectocele, cyst of the vagina or ovary, etc. If the hernia has made its way to the labium majus and the fact of intestinal protrusion is recognized, the physician will naturally believe it to be an inguinal hernia. In such a case Stoltz's test should be applied as follows: The hernia is reduced, the inguinal ring closed by the thumb, and the woman instructed to cough; if now the tumor reappears in the labium, an inguinal hernia may be excluded. The hernia is now reduced for the second time and a finger in the vagina compresses the latter against the ischium on the side of the hernia. If the patient coughs now, the hernia does not reappear. *Treatment:* If the diagnosis of vaginal hernia is made early enough in the course of the labor, the indication is to reduce the hernia and hold it back until the descent of the head into the vagina prevents any further probability of prolapse during labor. To reduce the hernia it may be necessary to apply the taxis under an anesthetic, although the knee-chest position may answer in some cases. Conjoined manipulation (abdomino-vaginal and vagino-rectal) may in certain cases serve for the reposition. In irreducible hernia during labor the indication is to terminate the latter with all haste after dilatation has occurred.

XXIV. CARDIAC AND PULMONARY DISEASE.

Asystole in Labor.—The bearing of organic heart disease upon marriage, pregnancy, and the interruption of gestation has already been considered (page 326). If a patient in whom the disease has passed the period of compensation should become pregnant and go on to term, death is pretty certain to happen during delivery. Neumann* publishes a case of this sort and cites a number of similar instances. Under these circumstances, however, it has been possible to save the child's life by rapid forceps extraction. (See Coffin Birth, page 669.) If the woman is not dead but nearly moribund when the physician reaches the lying-in chamber, it is still possible to rescue her, as shown by a case cited by Neumann. The patient, six months pregnant, was asystolic, presenting anasarca, ascites, and orthopnea. She was held in a nearly upright position by several attendants for some hours, or until the cervix could be dilated and the child perforated and extracted. She recovered from the asystole. In labor with organic heart disease properly compensated, the indications do not vary from those which obtain in delivery under normal conditions. It has been claimed that the rapid fall in the intra-abdominal pressure which follows the emptying of the uterus in these cases may lead to death post-partum. To lessen the danger a sand-bag can be placed upon the abdomen after delivery.

Pulmonary Disease.—Acute obstruction of the larynx from any cause may bring on labor, and under these circumstances the fetus is likely to perish from asphyxia *in utero*. Tracheotomy is indicated in the interest of both mother and fetus. If after tracheotomy the mother is moribund, Cæsarean section may save the child. If pneumonia coexists with labor, the cardiac insufficiency which accompanies this disease may lead to acute pulmonary œdema and death. If labor is impending during pneumonia, efforts should be directed to securing delay. After labor is under way it should be hastened with all due speed.

XXV. CEREBRAL AND SPINAL DISEASE.

The severe forms of neuroses, such as epilepsy, hysteria major, and the grave form of chorea gravidarum, appear to exert but little influence on the labor. Meningitis has sometimes occurred in pregnancy either with or without erysipelas. When labor begins, convulsions develop. Cases of labor complicated with chronic spinal diseases are on record. One case is recorded in which there was a chronic myelitis of the whole cord with paraplegia and anesthesia extending as high as the umbilicus. The mother suffered no pain. In tabes dorsalis the course of labor is normal in the great majority of cases.

Delirium or Insanity of Labor.—In very sensitive patients the natural suffering and restlessness incident to labor may pass into a state of transient fury, the explosions occurring during the pains. These women tear their hair, beat the wall, and indulge in furious cursing. This acute psychosis is especially noticeable in unmarried women, as I have observed numerous cases at the Emergency and New York Maternity Hospitals among this class of patients. After delivery the patient has no recollection of this state of mind. Technically this condition is an acute delirium and not true insanity. The treatment is based upon general principles.

* "Centralbl. f. Gynäk.," March 10, 1900.

XXVI. DIGESTIVE DISTURBANCES.

Pernicious Vomiting.—Under certain circumstances labor may be much disturbed by pernicious vomiting. The causes comprise actual organic disease of the stomach and functional disturbance from errors in diet. The determining cause of a paroxysm of vomiting is a severe labor pain. The coincidence of labor and vomiting is not unusual in anemic primiparæ. Mental emotion is also a cause. As this vomiting may presage the development of eclampsia or some other affection, it is best to terminate labor at once. **Hematemesis** may occur during labor when gastric cancer or ulcer is present, but it does not constitute an indication for hastening delivery. Rupture of the spleen sometimes occurs during labor and always ends fatally.

XXVII. SUDDEN DEATH DURING LABOR.

Sudden death may occur during parturition from a great variety of causes. Predisposing causes may exist before labor, the latter acting as a determining cause; or the death may be the termination of a condition produced by pregnancy itself. (1) The predisposing causes independent of pregnancy: (*a*) Circulatory —valvular heart disease, rupture of a diseased aorta, hydropericardium, fatty heart; (*b*) respiratory—suffocation during labor from presence of a goiter, or from hydrothorax; (*c*) digestive, etc.—rupture of spleen; (*d*) cerebrospinal—cerebral apoplexy. (2) Predisposing causes as a consequence of pregnancy: (*a*) Eclampsia; (*b*) hemorrhage, as from placenta prævia, too early detachment of a normally seated placenta, rupture of the uterus, or of varicose veins in the broad ligament; (*c*) entrance of air into veins: this accident occurs in placenta prævia, cancer, rupture of the uterus, and in manual and instrumental intervention. (3) Unknown causes of death. Death has occurred suddenly from the mere introduction of the hand into the vagina for the purpose of performing version. (4) Shock. (See Part VII.) (See Sudden Death in the Puerperium, Part VII.)

XXVIII. POST-MORTEM DELIVERY—COFFIN BIRTH.

Post-mortem parturition acquires its obstetrical and medico-legal importance from the possibility of physicians and midwives—the latter particularly—being made defendants in suits for malpractice on the ground of the delivery of the child after the death of the mother, and on the contention that this accident was preventable and due to lack of skill or to ignorance on the part of the practitioner. The case reported by Moritz * is the best illustration to be found of this charge. Three theories, according to Aveling,† have been advanced in explanation of the phenomenon. The first is that it is caused by the contraction of the uterine walls in rigor mortis. This seems hardly worth consideration, for the contractions are not sufficiently powerful to overcome the natural obstacles to the passage of the child, with the superadded narrowing and rigidity of the parturient canal from the same cause. The second theory is the pressure of the putrefactive gases in the abdominal cavity, acting on the point of least resistance, expelling the fetus and pushing the uterus before it until it lies outside the

* Moritz: "Vierteljahresschrift f. gericht. Med.," p. 93, Bd. v, 1893; also Bleisch: "Vierteljahresschrift f. gericht. Med.," 1892, Bd. III, p. 38.

genitals distended with foul-smelling gaseous products.* There can be no doubt that this explanation is the true one in a majority of instances, but there still remains a class of cases which it will not explain, since the birth took place too early for decomposition to have advanced so far as to produce sufficient pressure of gas. To cover this ground a third cause has been proposed in the conservation of power in the uterine muscle for some time after death (two hours is the limit generally placed). This contractile irritability preserved after death has been noted by various writers. Fodéré † says that "the uterus may expel the fetus after death, its organic action being conserved after dissolution has taken place." Baudelocque‡ found the uterus contracted after the lapse of a few hours in a woman whom he had delivered immediately after death. Arbeiter § found a like condition of affairs, delivery of the child having been accomplished by version and extraction three-quarters of an hour after death. During the operation the uterus was flaccid, but it contracted later into a hard ball. Leroux‖ cites a case of the same character, and others are on record. The uterus is often said to be the last portion of the body to lose its power of contraction and the last also to undergo decomposition. It is possible, then, to believe that when birth occurs within a few hours after the mother's death, the force retained in the voluntary muscles of the walls of the uterus is sufficient to complete the labor.

Dr. W. W. Rangeley, of Christainsburg, Virginia, in a personal communication, has kindly furnished me with the following case of coffin birth: Upon May 7, 1901, Mrs. J. Vaden died suddenly, and after the usual interval was buried, she being at the time of her death ten months pregnant. All the parties present at the time the body was placed in the coffin testified that at that time there was no evidence of birth. Subsequently the husband was suspected of having poisoned his wife, so on May 18, 1901, the coffin was opened in the presence of a coroner's jury, and the body examined by Drs. Rangeley and M. B. K. Linkous. The abdomen was partly distended with gas so as to resemble pregnancy, and it was the first impression that the fetus had not been born. Incision of the abdomen caused it to collapse, and then search was made for the child, which, with cord and placenta attached, was found well down under the thighs. The child weighed nine and a half pounds and was dead. The uterus was, unfortunately, not examined. The body was in a state of decomposition, but the fetal cadaver was well preserved. The cord was strong enough to sustain the weight of the placenta when suspended. The opinion of the physicians present was that the intra-abdominal gas pressure expelled the fetus after the effects of rigor mortis had subsided.

Can the Fetus Live After the Death of the Mother?—While we may be permitted a doubt in such a case as that of Reiss,** in which, according to that author, a day passed before a living child was born, the answer to the question must be in the affirmative when the interval is only an hour or less. In the discussion of Aveling's paper, Dr. Madge†† stated that he had observed fetal movements after death in several cases and wished to extract the child by Cæsarean section but was not permitted. Brunton ‡‡ after a quarter of an hour extracted a living child from the mother's corpse. Buffon and Shierig have taken living animals from the bodies of female beasts hours after death. The author has done the same in the case of a fox.§§

*See cases 65 to 67, author's article in Witthaus and Becker: "Medical Jurisprudence," vol. II, pp. 370–376.

† "Méd. Lég.," vol. II, p. 11.

‡ "Dict. des Sciences Méd.," XXX, p. 388.

§ "Monats. f. Geburtsh.," April, 1862.

‖ "Traité des Pertes de Sang."

** G. A. Reiss: "Gentleman's Magazine," vol. XXIX, p. 390.

†† "Trans. Obstet. Soc. London," XIV, p. 240.

‡‡ Ibid., XIII, p. 88.

§§ For instances in which living children have been extracted from fifteen to thirty-two minutes after the mother's death, consult Breslaw: "Monats. f. Geburts.," B. 20, p. 62; Pringler: "Monats. f. Geburts.," B. 34, S. 244 u. 251; Botherston: "Edinburgh Med. Jour.," April, 1868, p. 930; Welponer: "Wiener med. Presse," No. 1, 1897; Buckel: "Trans. London Obstet. Soc.," XIX, p. 179; Edgar: Witthaus and Becker, "Medical Jurisprudence," vol. II, pp. 369–379 (William Wood & Co., New York, 1894).

XXIX. THE METRORRHAGIA OF LABOR; PARTUM OR INTRA-PARTUM HEMORRHAGE.

For convenience' sake, I am accustomed to describe intra-partum hemorrhages as those of—(1) the first and second stages; and (2) of the third stage. (1) *Intra-partum hemorrhage of the first and second stages:* This is due principally to (*a*) *premature separation of a normally or abnormally situated placenta;* (*b*) ruptures of the uterus or cervix; and (*c*) fibroid tumors, malignant disease of the genital tract, or rupture of varicose veins. (2) *Intra-partum hemorrhage of the third stage;* Here, first and foremost stands (*a*) *uterine inertia* as the most important etiological factor; uterine inertia occurring with a partial or complete separation of the placenta. Next in importance come (*b*) *lacerations of the genital tract*, namely, of the lower uterine segment, the cervix, vagina, and perineum. Another important cause, not often taken into account, is (*c*) *insufficient contraction of the lower uterine segment in cases of low implantation of the placenta.* Here, while the fundus contracts firmly and completely, an imperfectly contracted lower segment permits of fatal hemorrhage from the open blood-vessels of the low-situated placental site. (*d*) *Partial or complete inversion*, although a most infrequent cause, must be enumerated; and the likelihood of *fibroids* of the uterus or *cancer* of the genital tract must be borne in mind.

PART SIX.

Physiological Puerperium. The Puerperal Woman.

DEFINITION. INTRODUCTION.

I. GENERAL PHENOMENA. (Page 673.) Exhaustion. Chills. After-pains. Pulse. Temperature. Respiration. Skin. Kidneys. Muscles. Blood. Heart. Weight. Psychical Changes.

II. LOCAL PHENOMENA. (Page 677.) External Genitals. Vagina. Cervix and Cervical Canal. Lochia. Bladder. Involution. (1) Height of Fundus. (2) Uterine Muscles. (3) Vessels. (4) Decidua. (5) Placental Site. (6) Adnexa. Alterations in Mammæ and Milk Secretion. Subsequent Impregnation.

III. DIAGNOSIS OF THE PUERPERIUM. (Page 687.) 1. Signs of Recent Delivery in the Living and the Dead. 2. Primipara and Multipara. Feigned Lying-in State.

IV. MANAGEMENT OF THE PUERPERIUM. (Page 688.) 1. Introduction. 2. Asepsis. 3. Rest. 4. Professional Visits. (1) Temperature. Pulse. Respiration. (2) Height and Condition of the Uterus. (3) The Lochia. (4) External Genitals. (5) Bladder. (6) The Bowels. (7) (8) The Breasts and Nipples. 5. Diet. 6. Posture and Duration. 7. Prophylaxis. (1) Abdominal Binder. (2) Pelvic Binder. (3) Medication. (4) Massage and Exercise. (5) The First Use of the Corset. 8. The Examination of the Puerperium.

Definition.—The puerperium is the period from the completion of the third stage of labor to the time when the uterus has returned to its normal dimensions. Its duration is six weeks or more.

Introduction.—The size of the uterus at the fortieth week is 12 inches × 9 inches × 8½ inches; its weight two pounds, and capacity 400 cubic inches. The size of the uterus at the end of the puerperium is 3½ inches × 2½ inches × 1½ inches; its weight an ounce and a half to two ounces, and capacity one cubic inch. The changes which go on in the uterus and its adnexa during this period and that bring about the above results are known as the changes of involution. The process is a physiological one, but closely borders on the pathological. To understand this we have only to remember (1) the absorption of two pounds of uterine tissue; (2) the formation of thrombi in the uterine walls; (3) the rapid cell production upon the internal surface of the uterus; (4) the atrophy and fatty metamorphosis in the uterine walls; (5) the tearing across of blood-vessels at the placental site, leaving large raw surfaces with the dangers of septic absorption; and, finally, (6) in most cases, including all primiparæ, the actual traumatic lesions in the nature of contusions and lacerations of the cervix, vagina, and vulva.

I. GENERAL PHENOMENA.

Exhaustion.—The action of the recuperative forces of nature is seen to great advantage after normal labor. As a rule, the patient recovers from the trying ordeal much more rapidly than would be expected, and in the absence of excessive hemorrhage or septic infection, this is usually the case even after severe and protracted labors and operative delivery. Immediately after delivery there is a natural tendency to rest and sleep, and from this repose the woman wakes in a state of perspiration and much refreshed and strengthened. Nervous, irritable women, however, do not readily fall asleep at this period. More or less thirst is present, due to increased excretion by the skin and kidneys, with a certain amount of burning pain in the external genitals, depending upon birth traumatisms.

The Post-partum Chill.—A chill of short duration, but which may be pronounced in character, frequently follows the completion of labor. The pulse and temperature are not altered and the chill is not of clinical importance. It is most frequently observed after rapid labors, and is probably due to the internal congestion caused by the sudden decrease in the intra-abdominal pressure which causes a rapid recession of blood from the surface of the body. The chill disappears without treatment, but something can be done to aid the recovery of the circulatory equilibrium by covering the patient with warm blankets. The chill may also be due to the wetting of the surface by perspiration, blood, and amniotic fluid; to the sudden cessation of muscular effort ; to loss of blood, or to withdrawal of the warm fetus and placenta.

After-pains.—Post-partum contractions which continue for several days into the puerperium are frequently seen in practice and are quite painful at times. They may occur spontaneously or only when the child is applied to the breast. They appear more commonly on the first than on the second day and affect multiparæ by preference. When a primipara has after-pains, they occur, as a rule, as a sequel to some particular type of labor, such as involves precipitate delivery, or previous overdistention of the uterus, *i. e.*, twins or hydramnios. They are also associated at times with the retention of blood-clots and decidual structures. While the same factors may be present in the after-pains of multiparæ, they are often notably absent.

Pulse.—With the rapid fall in arterial tension which occurs during and after delivery there is a marked diminution in the frequency of the pulse. From 60 to 70 is about the normal rate after delivery, and occasionally it is even less. A rapid pulse at this time should lead the attendant to suspect the existence of hemorrhage or some other complication. I found the pulse in 1417 observations one hour after delivery as follows:

40	to	50	in	2	cases.	100	to	110	in	48	cases.
50	"	60	"	13	"	110	"	120	"	23	"
60	"	70	"	345	"	120	"	130	"	3	"
70	"	80	"	566	"	130	"	140	"	2	"
80	"	90	"	302	"	140	"	150	"	2	"
90	"	100	"	110	"	160			"	1	case.

Total .....1417 cases.

The pulse of the normal puerperium is slow and soft, and often irregular and intermittent. It is also very irritable and easily accelerated by trivial causes. But these qualities are by no means constant in all puerperæ, at least in notable degrees. Temesvary states that a slow pulse occurs in but 60 per cent. of normal puerperal women. In certain cases the pulse-rate falls to 36, 32, even to 30 beats per minute. The frequency before delivery is about 86, while the average frequency throughout the puerperal period is about 63, so that the result of delivery is a reduction in the pulse-rate of over 20 beats. Immediately after delivery the pulse falls to about 72, but after irregular labors not below 75. The rate now sinks a little each day until it arrives at a minimum (average 57) on the eighth day. It remains at this level until a period near the end of the second week, when it begins to rise again until it attains its normal level. This tendency to a lowering of the pulse-rate is antagonized by hemorrhage or fever from any cause, so that a pulse-rate of moderate frequency early in the puerperium may or may not have an unfavorable significance. As the effects of the complications wear away, the slowing of the pulse may assert itself later in the puerperal period. When a slow puerperal pulse becomes accelerated without evident cause, we should fear possible embolism of the lungs. The causes of the slow pulse of the puerperal period are still unknown. It is likely that several factors co-operate to produce this result. One is the absolute rest in bed, another the lowering of the arterial tension, a third the relief of the lungs which leads to slowing of the respiration, etc. But if these factors alone were the occasion of a slow pulse, the latter should be common to all puerperæ. The absence of constancy in this respect appears to point to the nervous system, which shows such individual peculiarities, as largely responsible. Certain unknown factors may produce the slow pulse through the vagus nerve or accelerator nerves of the heart. The apex of the heart is lowered nearly ¾ inch (2 cm.) after expulsion of the fetus, and a slight impurity of the first sound manifested by a blowing murmur persists for

about a week in about three-fourths of all puerperæ. The uterine souffle has been found to last, on an average, about fifty-six hours after delivery, and considerably longer if the puerperium is abnormal. It is less marked than during pregnancy and its persistence beyond a certain period shows a delay in the process of involution.

Temperature.—This is slightly raised by the act of labor, so that the measurements taken just before and just after labor should exhibit a certain difference. This physiological increase is not to be confounded with a considerable elevation seen in individual cases, which lasts but a short time, and which is attributable to constipation, a disordered stomach, or mental influence. The physiological rise averages about 0.48° F. (0.27° C.). For the first six or seven hours after delivery the temperature continues elevated, and then sinks slowly, so that considerably before the expiration of the first twenty-four hours it has returned to the ante-partum point. The temperature curve is the same in primiparæ and multiparæ. It varies slightly with the period of the day at which delivery occurs. The normal rise of temperature in the puerperium is attributed by Temesvary to the changes in the circulation which follow expulsion of the child, there being an increase of pressure in the capillaries of the kidneys, liver, lungs, and skin. While the temperature is practically normal after the first day, there is a very slight constant daily fluctuation throughout the first few days, which is doubtless dependent upon the secretion of milk. In 1420 observations of the temperature one hour after labor I obtained the following table :

Temperature,	97.0° F.	to	98.4° F.	in 380	cases.
"	98.5° F.	"	98.4° F.	" 748	"
"	99.5° F.	"	100.4° F.	" 255	"
"	100.5° F.	"	101.4° F.	" 29	"
"	101.5° F.	"	102.4° F.	" 4	"
"	102.5° F.	"	103.4° F.	" 4	"
Total.....				1420	cases.

Respiration.—After delivery the rate of respiration is lowered, and may be anywhere between 14 and 20. The vital capacity is increased. An equilibrium is reached at about the third or fourth day. The type of respiration either continues to be thoracic from the habit acquired in pregnancy, or it becomes abdominal or mixed. The expired air contains a larger proportion of water and carbon dioxid than normal. This fact may be readily appreciated in a hospital ward full of recently delivered women if the ventilation is not oft he best. I found the respirations in 1173 cases one hour after delivery as follows:

Respirations,	15	to 20	in 486	cases.	
"	20	" 25	" 461	"	
"	25	" 30	" 186	"	
"	30	" 35	" 23	"	
"	35	" 40	" 14	"	
"	40	" 45	" 2	"	
"	55	" 60	" 1	case.	

Skin.—The free perspiration of the first four or five days of the puerperium is due undoubtedly to the increase in metabolism which is connected with uterine involution and the puerperal loss of weight. This active sweating exposes the woman to colds, and she must be carefully protected from overheating, sudden cooling, draughts, etc. The functions of the skin become normal at the end of the first week. The sweating is accompanied by abundant desquamation, which aids in the disappearance of the pigmentation and œdema of pregnancy The puerperal sweat is rich in butyric acid.

Stomach and Bowel.—The puerperal woman appears to have little inclination for solid food until lactation is established, after which the appetite becomes awakened. Digestion is slow throughout the puerperium and indigestion is readily provoked. These peculiarities appear to be due to the readjustment of the gastro-intestinal tube following the expulsion of the child. Thirst is often notably increased at the outset of the puerperium. A spontaneous movement of the bowels seldom occurs during the earliest puerperal days. The bowels have generally been evacuated thoroughly before delivery, and but little nutriment is taken until some hours after this event; the intra-abdominal pressure is reduced to a minimum and the natural peristalsis is much depressed; the woman is in perfect repose in the recumbent position; the perspiratory function is highly augmented, to say nothing of the activity of the kidneys, the lochial discharge, and the beginning secretion of milk. Through the coincidence of all these factors a natural stool would be almost an impossibility.

Kidneys.—During the first few hours after delivery there is usually little desire for urination, owing to a paretic state of the muscles of the bladder, the result of the strong compression during the expulsion of the child. The early urine is concentrated. An important fact in the physiology of the puerperium is the length of time which the patient can retain her urine without any sensation of repletion. In the statistics of Temesvary 35 per cent. of the women went from twelve to twenty-four hours without a spontaneous passage of urine, and in 6 per cent. this interval was prolonged to a period between twenty-four and thirty-six hours. The amount of urine which collects in the bladder during these protracted intervals is considerable. Catheterization under these circumstances is not desirable, and should be replaced by gentle frictions over the bladder, warm wet compresses or poultices, or simple elevation of the upper part of the trunk. (See Treatment.) The quantity of urine passed daily during the first puerperal week is larger than that voided by the non-pregnant woman, but considerably less than the amount secreted during the last weeks of pregnancy. In the first day or two of the puerperium the amount of urine is increased over that of subsequent days, and the density should be below 1020; after the third day it is usually above 1020. An increase in the amount of urea excreted during the lying-in period is attributed to the process of involution. Albumin occurs in the urine of many puerperal women, not reckoning cases of albuminuria of pregnancy. This is the result of the renal stasis which results from the act of labor. After the first twenty-four hours albumin should disappear from the urine. If the woman had albuminuria before pregnancy, the urine does not clear up until toward the close of the first week. Sugar (lactose) is found in the urine whenever there is any impediment to the secretion of milk, as in cases in which the child does not nurse sufficiently. But this stops abruptly if the woman does not nurse her child at the outset. The percentage of sugar is greatest at about the fourth or fifth puerperal day. Peptonuria attributed to the involution of the pregnant uterus begins in the second half of the first puerperal day, and, as a rule, lasts four or five days. This phenomenon is not constant.

Muscles.—The muscular fatigue and the semi-paretic state of certain muscles which result from the act of labor disappear promptly, as a rule; but exceptionally they last for days or even weeks. The woman has a somewhat similar experience when she first gets up, but this also rapidly disappears. Delicate women often exhibit an unnatural degree of mobility of the pelvic articulations.

The Blood.—It was formerly supposed that the watery elements of the blood were increased during pregnancy, while the hemoglobin and red corpuscles were relatively diminished. Later investigations have tended to disprove this statement. The decrease in hemoglobin and red corpuscles observed after delivery is probably due to hemorrhage, which occurs even in normal cases. The hyperinosis of pregnancy is increased during the puerperium owing to the presence of effete material in the circulation. The number of leucocytes in the blood is at a maximum during the third stage of labor. It sinks rapidly after delivery and attains a minimum at about the twelfth hour of the puerperal period. It begins to increase on the second day or a little later, to undergo another reduction when the secretion of milk has become established. The number of red blood-corpuscles and the proportion of hemoglobin also undergo a diminution after delivery, dependent in degree upon the amount of blood lost during labor. This reduction is followed by an increase, so that by the end of the first puerperal week the blood is of the same quality as before delivery.

The Heart.—In normal cases the heart speedily adapts itself to the decreased arterial tension and diminished volume of blood. It has been asserted that in consequence of the extra work required during pregnancy a hypertrophy of the left ventricle takes place which disappears after delivery, but this is not proved. (Compare Physiological Pregnancy, Part II.)

Weight.—During the first week there is loss of weight consequent upon the diminished appetite, the increased excretions by the skin, and the normal retrograde changes in the intra-pelvic viscera attendant upon the process of involution. The loss is estimated at nine or ten pounds. In addition to the loss of weight through the act of labor itself, there is a further loss which results from the great activity of the various secretions, the lochial discharge, involution of the uterus, absorption of œdema, etc. But with a proper amount of nourishment the reduction is not excessive. Equilibrium in weight is reached in about six or eight weeks, when it corresponds to the average before conception. In primiparæ, after twin pregnancies, and in women who do not nurse their children the loss in weight is proportionately greater. Delicate women may not regain their normal weight for months.

Nervous System.—During the first few days of the puerperium the woman is in a condition of irritable weakness which involves the special senses and the mind. This condition is aggravated by after-pains and by attempts of the child to nurse, etc. Mental excitement sometimes leads to rise of temperature (see Fever, Part VI), sleeplessness, and other ill effects. It is self-evident that every source of annoyance should be avoided.

II. LOCAL PHENOMENA.

External Genitals.—After delivery the external genitals are bruised and swollen and, especially in primiparæ, are the seat of various abrasions and lacerations. There is gaping of the labia majora and minora, and if labor has been prolonged considerable œdema may be present (Fig. 467). The vulva and perineum lose their secretions through absorption of the infiltration; the varicosities in the veins diminish, and pigmented areas fade out. The various superficial and deep contusions and lacerations gradually disappear, healing by epithelial migration, leaving whitish scars. In primiparæ, in addition, the remains of

the hymen undergo necrosis with the persistence of the so-called caruncular formations (Fig. 28). The abdomen remains wrinkled and pendulous for weeks and never regains its original appearance. Striæ atrophicæ are often apparent, dating from pregnancy.

Vagina.—The vagina is at first relaxed, its mucous membrane is smooth and flabby and the rugæ are absent. In a few weeks it very nearly regains its normal condition. It becomes narrower and shorter, although it never returns to its original dimensions. The folds which were effaced by the act of labor form anew, but never acquire their original number or sharpness of contour. The ostium vaginæ tends to remain somewhat patulous, especially behind, and a certain prolapse of the vaginal walls within the ostium is often present. The process of involution goes on more rapidly near the ostium vaginæ than in the upper portion.

Cervix and Cervical Canal.—The cervix after delivery is much distorted, but the external os can always be recognized (Figs. 531 and 636). Lacerations at this point are usually present. The cervix and vagina cannot at first be clearly

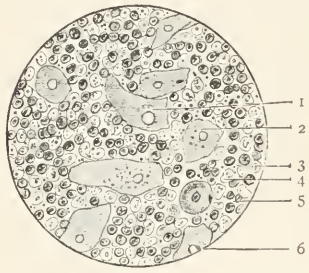

FIG. 907.—LOCHIA ON THE SECOND DAY OF THE PUERPERIUM. 1, 2, Epithelium; 3, 4, white blood-corpuscles; 5, red blood-corpuscles; 6, decidual cell.—(*Winckel.*)

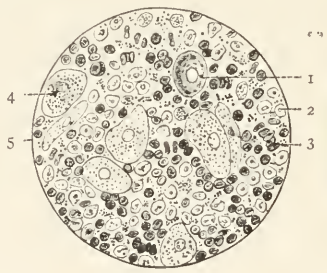

FIG. 908.—LOCHIA ON THE FOURTH DAY OF THE PUERPERIUM. 1, Decidual cell; 2, white blood-corpuscles; 3, red blood-corpuscles; 4, epithelium; 5, micro-organisms. —(*Winckel.*)

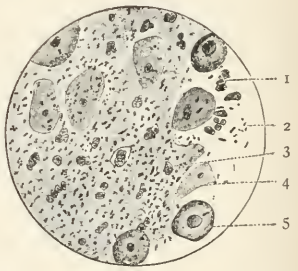

FIG. 909.—LOCHIA ON THE SEVENTH DAY OF THE PUERPERIUM; AFEBRILE CASE. 1, Red blood-corpuscles; 2, diplococci and monococci; 3, white blood-corpuscles; 4, epithelium; 5, decidual cells.—(*Winckel.*)

distinguished from each other, but after twelve hours the distinction becomes marked. At the tenth day post partum the internal os admits the passage of the index-finger readily in about 60 per cent. of primiparæ and about 70 per cent. of multiparæ,* but soon thereafter closes. The external os admits the finger much longer and never exactly regains its former condition. Immediately after delivery the cervix gapes, and the canal is so patulous that it will accommodate half the hand. This condition rapidly changes through thickening of the cervical wall, the cervical folds reappear at the same time, and by the twelfth day its involution is almost complete. On the contrary, the portio vaginalis requires some five or six weeks to regain its original condition. The lips of the external os immediately after delivery project into the vagina as soft tumors. If the anterior lip has been incarcerated during labor, it may reach as far as the vulva.

The Lochia.—By this term is understood the utero-vaginal discharge which continues for two or more weeks after delivery. For the first three or four days it is called the *lochia rubra* (*red lochia*), and consists principally of blood and

* Author's observation of several hundred cases.

blood-clots with some admixture of the epithelial elements of the vagina and cervix and fragments of decidua (Fig. 907). For the next three or four days it is mainly serous in character and is called the *lochia serosa* (*serous lochia*) (Fig. 908). After this, as the separation, disintegration, and casting-off of the products of involution go on, it becomes thicker and whiter in color and is called the *lochia alba* (*white lochia*) (Fig. 909). It contains disintegrated tissues of the birth canal, the secretions from granulating wounds, and microorganisms, which, it should be noticed, are not found for the first day or two, are confined to the vaginal secretions, and under ordinary circumstances do no harm. In normal conditions the uterine lochia is to be regarded as sterile. The amount of the discharge has been estimated as follows: For the first four days $2\frac{1}{5}$ pounds (1 kilo); for the second two days, about 9 ounces (256 gm.); until the ninth day, nearly 7 ounces (199 gm.). Under ordinary circumstances if more than one change of napkins is needed every four hours for the first few days, the amount is to be regarded as excessive. After the first two or three days the lochia has a peculiar sickish, but not putrid, odor. It is important that the physician should be familiar with this odor in order that he may recognize a departure from the normal and that odorless vulval dressings be employed. The discharge is more profuse in multiparæ than in primiparæ and in women who do not nurse their children than in those who do. A diminution in the usual amount of the discharge should be regarded with suspicion. Suppression is often a sign of sepsis.

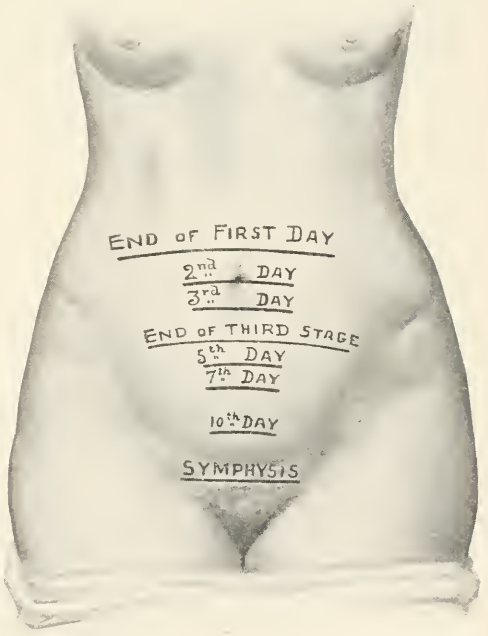

FIG. 910.—HEIGHT OF THE FUNDUS DURING THE FIRST TEN DAYS OF THE PUERPERIUM. —(*From the author's measurements.*)

The Bladder.—Owing to the increased quantity of urine, the sudden decrease of intra-abdominal pressure, reflex urethral spasm, the bruising and swelling of the tissues, and especially to the recumbent position, retention of urine frequently occurs.

Involution.—After the expulsion of the fetus and secundines the uterus contracts upon itself, so that the fundus is below the level of the umbilicus. Immediately after delivery examination reveals a mass equal to that of a pregnant uterus at the twentieth week. Its weight is 26 to 35 ounces (750 to 1000 gm.); length 6.3 to 7 inches (16 to 18 cm.); length of cavity 5.9 inches (15 cm.); thickness of wall 0.98 to 1.57 inches (25 to 40 mm.). At the eighth day of the puerperium the mass of the uterus should be reduced one-half. Thus, the weight after delivery is 26 to 35 ounces (750 to 1000 gm.); at eighth day, 14.9 to 17.6 ounces (400 to 500 gm.); on the fourteenth day, 13 ounces (350 gm.); on the fourth week, 7.5 ounces (200 gm.). Finally, at the end of two months the uterus

has regained its original weight of 1.85 to 2.78 ounces (50 to 75 gm.) and length of 2.95 inches (7 cm.). I found the length of the uterine cavity from the external os, measured with a sound on the tenth day of the puerperium in 119 primiparæ, 3.21 inches (8.15 cm.), and in 99 multiparæ 3.53 inches (8.97 cm.).* The first step in involution is the permanent contraction of the uterus, which should occur about one and a half or two hours after the birth of the child and immediately after the expulsion of the placenta. Active contractions are succeeded by a period of retractility due to the natural resiliency of the uterine wall and muscular tonus. This is also exerted during the period of active contraction in such a manner that each active postpartum contraction effects an absolute and permanent reduction in the size of the uterus. It is due to the persistence of this retractility that involution becomes possible. Uterine retractility is under the influence of the central nervous system, as shown by its inhibition under the influence of mental emotion even late in the puerperium. Its arrest under these conditions may be accompanied by secondary hemorrhage. The amount and character of nutriment and the rate of metabolism are also known to modify the process of involution, which goes on more slowly by night than by

FIG. 911.—PUERPERAL UTERUS FIFTY-THREE HOURS POST PARTUM. NORMAL PUERPERIUM.—(*Modified from Sellheim.*)

FIG. 912.—SAGITTAL SECTION OF A PUERPERAL UTERUS FIFTY-THREE HOURS POST PARTUM. NORMAL PUERPERIUM.—(*Sellheim.*)

day. The uterus in which involution is already under way may still undergo active contractions (after-pains) from reflex stimulation by the nursing child. The uterus is known to be slightly smaller just after delivery than at the completion of the first three puerperal days. This is due to the manipulation of the

* If the practitioner wishes to estimate the progress of involution with the sound, the bladder should first be completely emptied.

uterus in connection with the third stage of labor and the early post-partum hours, producing an initial reduction in size which is followed by a slight reaction. Measurements of the height of the fundus above the symphysis during the early puerperal days are as follows.

(1) Height of Fundus.—From careful measurements taken in 321 primiparæ and 709 multiparæ, during non-febrile puerperia, I found the height of the fundus above the symphysis to be as follows:

TABLE OF HEIGHT OF FUNDUS ABOVE SYMPHYSIS.*

Time.	321 Primiparæ. Average Height.	709 Multiparæ, Average Height.	Total Average.
Immediately after third stage	5.93 in. (15.10 cm.).	5.92 in. (15.10 cm.).	5.92 in. (15.8 cm.).
First day	6.06 in. (15.24 cm.).	5.35 in. (13.60 cm.).	5.70 in. (12.90 cm.).
Second day	4.61 in. (11.50 cm.).	4.66 in. (11.50 cm.).	4.63 in. (11.30 cm.).
Third day	4.49 in. (11.40 cm.).	4.26 in. (10.79 cm.).	4.37 in. (11.10 cm.).
Fourth day	3.82 in. (9.60 cm.).	3.68 in. (9.20 cm.).	3.75 in. (9.52 cm.).
Fifth day	3.14 in. (7.90 cm.).	3.27 in. (8.30 cm.).	3.20 in. (8.00 cm.).
Sixth day	3.13 in. (7.85 cm.).	2.97 in. (7.50 cm.).	3.42 in. (8.48 cm.).
Seventh day	2.91 in. (7.40 cm.).	2.89 in. (7.40 cm.).	2.90 in. (7.40 cm.).
Eighth day	2.50 in. (6.35 cm.).	2.60 in. (6.45 cm.).	2.55 in. (6.40 cm.).
Ninth day	2.54 in. (6.40 cm.).	2.10 in. (5.30 cm.).	2.32 in. (6.00 cm.).
Tenth day	2.49 in. (6.34 cm.).	1.96 in. (5.00 cm.).	2.22 in. (5.60 cm.).

Statistics of the width of the uterus show a corresponding diminution. During the first two puerperal days the width is greater than immediately after delivery. Upon the tenth day post partum the uterus does not lie entirely in the true pelvis, as is so often stated. My observations show that in primiparæ the fundus on the tenth day is still 2.49 inches (6.34 cm.) above the symphysis, and in multiparæ 1.96 inches (5.00 cm.)—a total average of 2.22 inches (5.60 cm.). While its position at the onset of the puerperium is one of retrodisplacement (Fig. 912) as a result of its weight and the laxity of its ligaments, the conditions are reversed in involution, so that by the ninth day the position is one of anteversion or anteflexion, which increases as involution progresses (Fig. 911). A certain degree of rotation on the longitudinal axis is often present. Hansen (cited by Temesvary) has made measurements which show that the distance from the fundus to the external os diminishes up to the tenth week post partum. These figures appear to be a suitable criterion for the duration of the process of involution. They also show that the uterus never entirely regains its original length. By this means it may also be shown that involution occurs with less delay in multiparæ and nursing mothers. Involution is also known to be delayed after hydramnios, twin births, labor in contracted pelves, hemorrhage, premature delivery, puerperal disease, and the action of psychical influences.

(2) Muscle.—We know that the original muscular fibers of the uterus

* Temesvary gives the following table:

Immediately after delivery	4.29 inches	(10.91 cm.).
First day	5.33 "	(13.55 cm.).
Second day	4.9 "	(12.45 cm.).
Third day	4.39 "	(11.16 cm.).
Fourth day	4.02 "	(10.21 cm.).
Fifth day	3.66 "	(9.29 cm.).
Sixth day	3.24 "	(8.22 cm.).
Seventh day	3.00 "	(7.61 cm.).
Eighth day	2.88 "	(7.32 cm.).

increase in size during gestation. Therefore in involution the hypertrophied individual elements must undergo reduction to their normal dimensions. This is effected by fatty metamorphosis of the protoplasm of the muscle-fibers. The primitive fat-drops coalesce to form large collections between the muscular bundles, whence the fat is taken up by the blood- and lymph-capillaries. The appearance of fat-drops in the uterine muscle-cells is an evidence on the first day post partum. The process of involution affects the nuclei of the muscle-cells as well as the substance proper. Within recent years it has been shown that a glycogenesis occurs at the same time as fatty transformation (Fig. 913).

(3) Vessels.—Involution of the larger vessels is accomplished by proliferation of the intima occurring side by side with fatty degeneration of the media. The capillaries appear to be destroyed outright by compression, passing rapidly into a state of fatty degeneration. The nutrition of the uterus is maintained by the partially obliterated vascular trunks.

Fig. 913.—Muscle-fibers of the Uterus on the Sixth, Tenth, and Eighteenth Days of the Puerperium.

(4) Decidua.—When the membranes are cast off at the completion of delivery, the separation occurs at the so-called ampullary layer of the decidua. This leaves a thin stratum of decidual tissue which serves as a temporary lining for the uterus (Fig. 914). At the serotinal portion the surface is more or less bloody. The remainder of the lining is raw, shreddy, and uneven through the forcible separation of the dilated uterine glands. Portions of the decidual layers which are normally cast off at birth may remain to undergo gradual necrosis and expulsion with the lochia (Figs. 907 to 909). The persistent portion of the decidual tissues undergoes transformation into connective-tissue corpuscles, thereby laying bare the original mucous membrane of the uterus, from the epithelial cells of which a new mucosa is generated. The epithelium in this case comes from the uterine glands and rapidly proceeds to cover the bare septa between them. This process of repair is always accompanied by an abundant exudation and leucocytosis. According to some authorities, the persistent decidual cells become transformed into epithelium.

(5) Placental Site.—This portion of the inner surface of the uterus necessarily undergoes a reduction in size corresponding to that of the uterus itself. The open sinuses are at first protected by firmly adherent clotted blood and the majority become occluded by thrombosis, the remainder by muscular compression. The placental site is still recognizable for from four to six weeks after delivery and is indicated by a prominence $\frac{2}{5}$ to $\frac{4}{5}$ inches in width (1 to 2 cm.), the former blood-vessels persisting only as pigmented points. It thus appears that the placental site is the last portion of the uterus to undergo complete involution.

(6) Adnexa.—The ovaries, enlarged during pregnancy, gradually resume their original dimensions; the dilated and stretched tubes become narrow and tortuous; the peritoneal coat of the uterus contracts, and the laminæ of the broad ligament become unfolded and once more approach each other.

Changes in the Breast and Milk Secretion.—The changes in the breast up to the time of the puerperium have already been described. During the first three days of this period the so-called colostrum, an immature milk, is secreted. This is a turbid, watery fluid which exhibits whitish or yellowish streaks. The microscope shows that colostrum is an irregular emulsion, its fat-drops being of unequal size and adhering to one another (Fig. 917). This point serves to distinguish between this fluid and milk, the latter being a perfect emulsion (Fig. 916). Agglomeration of the fluid fat-drops into compact masses constitutes the so-called colostrum corpuscles. It is probable, however, that the latter really represent a complete fatty degeneration of the epithelium of the mammary gland. Colostrum is poor in casein and rich in serum-albumin; therefore, unlike milk, coagulates on boiling. The secretion of the breast loses its coagulability at the latest by the fourth day, showing the period of transition from colostrum to milk. The amount of breast secretion during the colostrum period is relatively insignificant. After its transition into milk the amount rapidly increases. From the third puerperal day the breasts increase rapidly in size and usually exhibit fulness and tension. Individual lobuli may often be felt, giving the gland a nodular character (Fig. 918). The swelling about the gland proper may even extend to the axilla, and may be accompanied by more or less pain. That a milk stagnation or milk fever ever occurs as a physiological phenomenon is now disputed; all evidence of this sort will doubtless, in time, come to be regarded as due to bacterial infection. (See Fever, Part X.) The period of active congestion which ushers in the secretion of milk proper does not last over two days when the woman nurses her child, and somewhat longer when she does not. In the latter case, when there is no demand for its secretion the milk gradually assumes the character of the original colostrum, and finally disappears altogether. The emptying of the breast in lactation is brought about as follows: The infant first causes an erection of the nipple so that the first milk that enters the sinuses of the excretory duct is abstracted by the pressure and suction of its lips. The *vis a tergo* is then brought into play through reflex stimulation of the gland by the act of suction, so that an

FIG. 914.—REGENERATING MUCOUS MEMBRANE OF THE UTERUS ON THE SIXTH DAY OF THE PUERPERIUM. 1, Portion of necrosed decidua with leucocytes free and embedded; 2, edge of firm decidua; 3, beginning formation of new epithelium; 4, glands lined with epithelium; 5, wall of granulation tissue under the necrosed decidua; 6, gland; 7, capillary blood-vessels; 8, disintegrating and degenerating decidual cells in a network of connective tissue; 9, muscle of the uterus; 10, deepest portion of the decidua containing spindle-shaped cells.—(*Bumm.*)

increase occurs in the secretory pressure. In a few moments after the application of the child a pain is felt in the breast and the milk is then seen to jet forth. This may often be observed simultaneously in the opposite breast, and even in both glands quite independently of the act of suction, from the mere thought of suction.

Human milk proper is a white, opaque fluid with an alkaline reaction, sweetish taste, and density of 1030. The microscope shows it to be composed of an emulsion of fat-drops in a fluid known as the milk plasma (Fig. 916). These fat-drops rise after the milk has stood for a few hours and compose the cream. During the first eight days of the puerperium, or up to the fourth or fifth day of actual secretion of milk, extraneous formed elements may be recognized by the microscope—blood-corpuscles, fibrin, colostrum corpuscles, etc. The fat-drops of the milk are composed of a number of fatty acids (palmitic, stearic, oleic, myronic, butyric, etc.) in combination with the glycerin radical, thereby forming triglycerides or neutral fats of the same class as those which make up adipose tissue of animals in general. The most important soluble ingredient of milk is the proteid matter, which appears to undergo considerable fluctuation in quality, so that a given test does not always respond in the same fashion. It is admitted that the principal proteid constituent is casein, and some chemists regard it as the sole proteid of milk. The majority, however, regard serum-albumin and nuclein as normal proteid ingredients. The existence of an albuminoid envelope about the fat-drops, so long maintained undisputed, is to-day denied. Heidenhain claims that the mere colloidal action of the casein in solution suffices to prevent the coalescence of the fat-drops. The casein is combined in the milk with calcium phosphate, which holds it in solution. If this salt is withdrawn from the combination by the addition of a few drops of a weak solution of hydrochloric or acetic acid, the casein is immediately precipitated. Spontaneous coagulation is due to the action of the *Bacillus acidi lactici*, which forms lactic acid from the lactose of the milk and thereby precipitates the casein. This separates the milk into a solid and a fluid portion known respectively as the *curd* and *whey*. Milk which curdles spontaneously is made sour through the formation of lactic acid. The action of rennet or lab ferment coagulates the milk without souring it. In human milk casein is always precipitated in small flocculi. In addition to the

FIG. 915.—SECTION THROUGH AN INACTIVE BREAST AT THE THIRD WEEK OF THE PUERPERIUM. 1, Skin; 2, adipose tissue; 3, tubercles of Montgomery; 4, nipple; 5, milk duct; 6, muscle; 7, glandular tissue; 8, milk ducts; 9, muscle.—(*Bumm.*)

proteid matter, milk contains milk-sugar (lactose), salts, and traces of a diastatic ferment. The amount of milk secretion is capable of increase up to the eighth month, after which it gradually declines. The daily average for the first week is about a pint (500 c.c.), which gradually increases till at its maximum it is over a quart (1.1 liters). As a general rule, lactation is completed at the end of a year, but this period is subject to many variations. A secretion of milk out of all proportion to the demands of the child is known as *polygalactia*, and if it persists when the child is not nursing it is termed *galactorrhea* (see Part VII). Defective secretion of milk is common in the very young or the elderly, in the delicate, weak, and cachectic. The obese also suffer in this respect, the breasts in such women being subdeveloped. According to Baumm and Illner, there are no true galactogogues, nor can the secretion of milk be modified by the diet; but the amount of milk can be much lessened by insufficient diet and then brought to the normal by generous regimen. The composition of milk varies more or less in the same woman, and while the gross amount is not affected by diet, the milk may be made richer in fat by

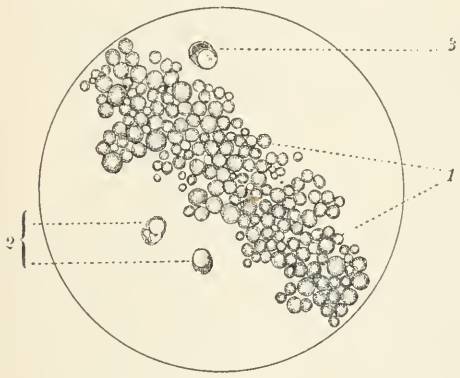

FIG. 916.—CONTENTS OF MILK. 1, Fat-globules (milk corpuscles); 2, milk corpuscles with the remains of the protoplasm of the gland epithelium; 3, milk corpuscles covered with nucleated protoplasm.—(*Bumm.*)

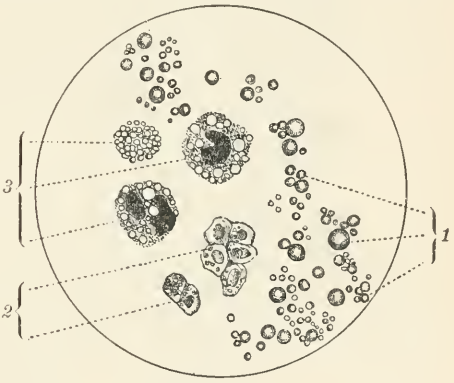

FIG. 917.—CONTENTS OF COLOSTRUM. 1, Fat-globules of different sizes; 2, epithelium of the milk ducts; 3, colostrum corpuscles. (Leucocytes containing fat-corpuscles.)—(*Bumm.*)

generous living. The limits of variability appear to be as follows: Proteids, 1.41 to 3.50 (per cent.); fat, 1.42 to 5.25; sugar, 5.04 to 7.76; ash, 0.16 to 0.36. The milk of a primipara is somewhat richer in solids than is that of a multipara. Age alone, within certain limits, is without effect upon the composition of the milk. The period of lactation exerts very little influence, although during the first ten days of the puerperium there is a steady decline in the proteid, which thereafter remains constant. Baumm and Illner have made many studies in connection with feeding nursing mothers. The milk as a whole, when in normal quantity, cannot be increased by feeding, although individual constituents may be thus affected. Thus, forced feeding with proteids or fats increases the percentage of fatty matter. Carbohydrates have no effect whatever. Increased ingestion of fluids is practically without effect. Illness of the nursing woman does no more than diminish slightly the solid constituents. Neither menstruation nor mental emotion has any notable effect on the milk. To sum up, we can maintain only one prominent truth in this connection: viz., that the richness of the milk—or, in other words,

the proportion of fat—can be modified in various ways. The following are some of the medicaments which, administered to the mother, may enter the milk: Certain coloring-matters, ethereal oils (wormwood, garlic, etc.), salicylic acid, potassium iodide, the heavy metals (lead, mercury, iron, bismuth), arsenic, antimony, atropin, chloral. Narcotics, including alcohol, while having a tendency to enter the milk, do so in such small quantities that the infant is not menaced. Human milk is practically sterile when secreted, but can readily be contaminated with staphylococci from the milk-ducts and nipple. In estimating the amount of milk, the usual methods of palpating the breasts and noting the force with which the milk spurts from the nipple are more or

FIG. 918.—SECTION THROUGH AN INACTIVE BREAST DURING THE PUERPERIUM. The epithelium of the acini shows various conditions. 1, Quiescent acinus; 2, acinus distended with milk; 3, 4, 5, secreting acini; 6, interacinous connective tissue; 7, capillaries; 8, secreting gland epithelium with large fat-corpuscles in the protoplasm, the nuclei being pressed against the cell-wall; 9, formed milk.—(*Bumm.*)

less sources of fallacy. A more sensible way of arriving at this knowledge is by the examination of the infant. By means of a proper scale the child may be weighed before and after each feeding. It should nurse from 1.8 to 7.2 ounces (50 to 200 gm.) according to age every two hours. Direct analysis of the milk is required only for the determination of the percentage of fat. High specific gravity means low percentage of fat, and vice versa. The microscope also gives information of some value in this direction, as does allowing the milk to stand twenty-four hours and computing the thickness of the supernatant cream, which should be 10 per cent. of the whole. For quantitative work the lactobutyrometer will give approximate results to the practitioner.

Subsequent Impregnation.—How soon after delivery can a woman again

be impregnated? G. L. Bonnar* reached some interesting conclusions in regard to this question. Not being satisfied with the then generally accepted opinion that a month must elapse between the termination of labor and a fresh conception, he undertook an investigation into what was known as "Hodge's Peerage and Baronetage." His results were as follows: In at least nineteen cases the interval between one birth and another was less than 309 days. In ten cases the interval varied from 309 to 300 days, in two from 299 to 290, in four from 289 to 280, in one it was 273, in another 252, in another 182, in another 173, and in one 127 days. Taking these cases into consideration, as well as the post-partum conditions of the uterus, lochia, and vagina, Dr. Bonnar placed the earliest date after confinement when the woman could again become pregnant as the fourteenth day. Leopold's observations appear to prove that the repair of the uterine mucous membrane after confinement is not complete earlier than the end of the fourth week; that the red and yellow lochia cease at the beginning of the second week, and that the white lochia continues until the sixth week. Observations would tend to indicate that one-half of those women who do not nurse their children, and also those women who menstruate during the period of lactation, have their first post-partum menstrual period, and hence ovulation and capability of impregnation, within six weeks after confinement.

III. DIAGNOSIS OF THE PUERPERIUM.

1. Signs of Recent Delivery.—As the physician is required to render a decision not only in the case of the living, but also in the dead, he must, from signs present, state whether or not a recent expulsion of the contents of a pregnant uterus has taken place. In the first instance, the case of the living, the decision is reached by the usual methods of diagnosis; in the case of the dead, the value of an inspection of the uterus and its appendages is added.

(1) Signs in the Living.—As in the diagnosis of pregnancy, so in the determination of the existence of a recent delivery in the living, there are a large number of signs of greater or less value. *Doubtful signs:* The uncertain symptoms prove nothing; they can exist in conditions other than that of the puerperium, and in the male as well as in the female. *Probable signs:* These include signs existing in the genital tract and in the mammary glands. (See Local Phenomena of Puerperium.) *Positive signs.* Positive proof of the occurrence of birth is furnished only by the discovery of parts of the ovum. If, upon careful microscopic investigation of the lochial discharges (see Figs. 907, 908, and 909) we fail to find any evidence of remains of the ovum, we can with the finger or curette remove the remains of the placenta from the inner surface of the uterus, and demonstrate under the microscope the tissue found, thus fully establishing the diagnosis. The demonstration of the shreds of decidua with large nucleated and fatty cells is of itself a sure proof. The diagnosis of the puerperal condition will rarely be found difficult within ten or fourteen days after parturition. In multiparæ the diagnosis cannot in some instances be positively established after the lapse of even a week or ten days. If the case is one of a primipara, the character, intensity, and persistence of the signs present will permit a diagnosis to be made at a later date.

Date of Delivery.—We are enabled to answer this question by carefully

* "Critical Inquiry Regarding Superfœtation, with Cases."

observing the character of the secretion from the breasts; the appearance and composition of the lochial discharge; the height of the fundus uteri in the abdominal or pelvic cavity; and particularly the freshness of the wounds that may exist in the genital tract.

(2) Signs in the Dead.—The diagnosis of recent delivery in the dead rarely presents any difficulty. Many, if not all, of the signs of recent delivery occurring in the living may be found in the dead, and, in addition, we are able to see the alterations in the uterine body and its appendages. The rate of return of the uterus to its normal size depends upon so many factors—as the period of gestation at which labor occurs, pathological conditions in the pelvis prior or subsequent to labor, the general condition of the woman, etc.—that any attempt to state positively from a post-mortem examination the exact date upon which parturition took place must result in failure. Four to six weeks after labor the placental site may still be recognized, but it is smooth and barely two-thirds of an inch across, and the places formerly occupied by the vessels are now marked by yellow and black spots of pigmentation. As to the signs of pregnancy revealed by a post-mortem examination, those of an objective character will in most cases be present. There are two which have not yet been mentioned: namely, (1) The finding of the ovum, embryo, or fetus within its envelopes in the uterus. The gross appearance of the ovum, embryo, and fetus in the several months of gestation will be found described on pages 82 and 83, and, of course, this furnishes reliable evidence. (2) The presence in one or both ovaries of a true corpus luteum. After the Graafian follicle or ovisac ruptures and discharges the ovum, a certain change takes place in the ruptured follicle which results in the formation of the corpus luteum (page 19). Modern investigation would seem to sustain the statement that no positive evidence is to be derived from either the false or the true corpora lutea. Instances are on record in which the so-called true corpus luteum has existed in the absence of pregnancy.

2. **Primipara and Multipara.**—In primiparæ we find the fragments of the freshly torn hymen, fourchette, and possibly perineum. The external genitals are usually, also, more swollen, reddened, and sensitive to the touch than in multiparæ.

3. **Feigned Lying-in State.**—(See Feigned Delivery, page 449.)

IV. THE MANAGEMENT OF THE PUERPERIUM. MOTHER.

Introduction.—The borderland between the physiological and pathological puerperium is not sharply defined. The parturient suffers from slight traumatisms almost through the entire genital tract; she has thrombi in the uterus at the former site of the placenta, and the birth canal is hypertrophied above and unduly relaxed below. Physiological conditions may so readily become pathological that the obstetrician should constantly be on his guard until the time of danger has passed (see page 673). As already stated (Part IV), the physician should remain with the patient for at least an hour after the completion of the third stage of labor. During this period, which is called "the physician's hour," the abdominal binder and first vulval dressing are applied as already described (page 496), after a thorough cleansing of the external genitals and neighboring parts with an antiseptic solution. The draw-sheet has, of course, been removed and all soiled clothing and bedding have been replaced by clean material. It is essential, however, that during

this process the patient be disturbed as little as possible, and if she is much exhausted she should be allowed to rest for a short time before anything is done. The head should be kept low and the patient not allowed to turn on the side. since she might assume the Sims position, which favors the entrance of air into the uterine sinuses and possibly air embolism. The management of the puerperium consists chiefly in: (1) cleanliness and (2) rest. In regard to cleanliness, the woman should be aseptic when she enters the lying-in bed; and after labor she should be kept as aseptic as possible. In regard to asepsis before labor, it is taken for granted that the pregnant woman has formed the daily habit of general bathing, cleansing the mouth, and external genitals.

1. **Asepsis during the Puerperium.**—In ordinary cases the resources of nature cannot be equaled by those of art. I have noted the importance of limiting vaginal examinations as much as possible in the first and second stages, and the danger of unnecessary manipulation in the third stage. No physician is competent to manage a case of labor who cannot in the great majority of cases so conduct the third stage that no internal manipulations are necessary. The same principles

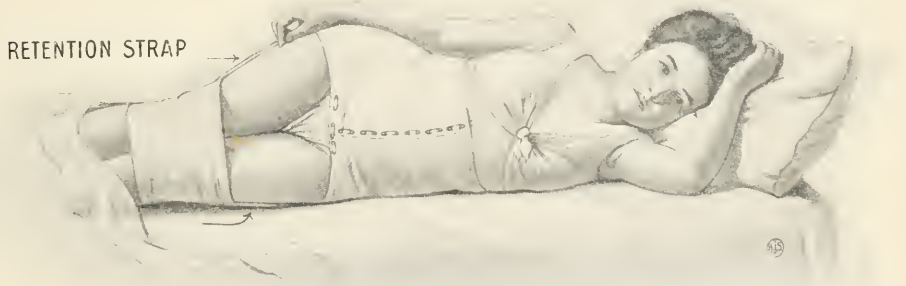

FIG. 919.—ABDOMINAL BINDER AND BREAST SUPPORT FOR THE NORMAL PUERPERIUM. The retention straps connecting the lower edge of the binder to a band about the thighs are used only when the binder shows a tendency to slip up above the pelvis.—(*From a photograph.*)

of treatment should guide him in the management of the puerperium. Douches are not indicated unless unfavorable symptoms arise; *e. g.*, high temperature or local fetor. (See Treatment of Septic Infection, Part VII.) Cleanliness of the patient and bedding, strict antisepsis of the external genitals, including disinfection of lochia and thorough ventilation of the lying-in room, are important points to be remembered. (1) *Antisepsis of the external genitals:* This is best secured by washing with sublimate 1 :4000, lysol solution (2 per cent.), and paying special attention to the flexures of the thighs or any folds or creases of skin which may serve as receptacles for septic material. The lips of the vulva need not be separated; all washing should be done from above downward and the tissues about the anus should be scrupulously avoided till all the other parts are cleansed. This cleansing of the external genitals should precede each application of the vulval dressing, and is best accomplished by vulval irrigation (Fig. 1055) supplemented with sterile cotton wipes. In all cases internal douches or other internal manipulations, especially by the nurse or others, in the absence of a distinct indication, are to be absolutely forbidden. There are always some abrasions

and small wounds in the genitals which if not treated antiseptically may become the starting-point of an infection; it is therefore necessary to conduct the vulval dressing with strict attention to these details. (2) *The vulval dressing:* There are three essentials of a vulval dressing: (*a*) It should be of absorbent material, that the accumulation of lochial discharge about the vulva may be prevented; (*b*) it should be saturated with an antiseptic material that the discharge may be sterilized; (*c*) it should be impermeable, that the air may be excluded. As an absorbent, gauze or cotton may be used, and should be borated or salicylated; sublimate is too irritating for this purpose. Deodorizing chemicals, or those with any odor, should not be used on the vulval dressing, as these mask the fetor of decomposing lochia, a valuable sign of early septic infection. Over the vulval dressing a long strip of salicylated cotton wrapped in gauze should be placed and attached in front and behind to the abdominal binder. The vulval dressing should be changed every four to six hours. While the foregoing precautions cannot be carried out in every case, it is fortunately true that if the vaginal examinations in the first two stages of labor are made with great care as to asepsis and limited as to number, if internal manipulations are carefully avoided during the third stage, and if strict cleanliness of the patient and bedding is observed, very good results can be obtained even in the most unfavorable surroundings.

2. Rest.—The first and most important requisite is that the patient should have a period of refreshing sleep. She may be allowed to see her husband or mother for a short time if she desires, but all other visitors should be rigidly excluded. She should not be disturbed by the congratulations of friends nor the intrusions of the curious, and if it is impossible to exclude them she should not know of their presence in the house, nor should she be disturbed by the crying of the baby. The room should be darkened and perfect quiet observed. It cannot be too often repeated that perfect cleanliness and absolute physical and mental rest should usher in the puerperium. The nurse, however, should from time to time note the pulse and general aspect of the patient, and the presence of uterine contractions. The exclusion of visitors and the observance of quiet should not be limited to the first day or few days, but should continue at least as long as the patient is confined to her bed.

3. Special Directions.—The patient should be seen again within twelve hours after delivery, or sooner if required by the frequency of the pulse, rise of temperature, excessive flowing, or any other unfavorable symptoms. Morning and evening visits may be made for the first two or three days, and daily visits till the tenth day or later, the patient being kept under observation till involution is complete. At each visit attention should be paid to (1) the mother's temperature, pulse, and respiration (A.M. and P.M.); (2) the height and condition of the uterus; after-pains; (3) the quantity, odor, and character of the lochia; (4) the condition of the external genitals; (5) the condition of the bladder; (6) the condition of the bowels; (7) the condition and secretion of the breasts; (8) the nipples; (9) diet; and (10) the general condition of the patient and the necessary treatment if any is required. Note should also be taken of (1) the child's temperature, pulse, and respiration, but it is unusual to take the infant's rectal temperature except for special indications; (2) the condition of the stump of the cord and the umbilicus; (3) the number and color of the stools; (4) the passage of urine; (5) the color and condition of the skin; (6) the condition of the eyes (inflammation); (7) maternal nursing or artificial diet; (8) the stomach as shown by vomiting; (9) the weight; (10) the condition of the nose and mouth; (11) the general condition as to sleep, excessive crying, colic, irritation. For the care of the

newly born infant, see Part VIII. (1) *Temperature, pulse, respiration:* A diurnal record should be made of the temperature and pulse, and when the latter is taken by the attending physician it is advisable to note its rapidity both at the beginning and at the end of his visit. Any departures from the normal standard should call for rigid investigation into the cause. (See Part VIII.) These three conditions should all return to normal on the second day. The pulse is accelerated during and immediately after delivery and the temperature may show a moderate rise during the first thirty-six hours, but after that any elevation of temperature should be regarded with suspicion (Part VIII). (2) *The height and condition of the uterus:* The height of the uterus above the symphysis should be estimated or measured; and the sensitiveness and contractility determined by abdominal palpation, not neglecting at the same time to search for evidences of perimetritis or parametritis by palpating over the adnexa and in the iliac fossæ. *After-pains:* These are caused by irregular and painful uterine contractions, and are often due to clots *in utero*. The use of the fluid extract of ergot, one drachm every three hours, is usually beneficial in cases of retained blood-clots. Should the sleep be much disturbed, codein in moderate doses, one-quarter grain every two hours for two or three doses, may be used as less likely to produce unpleasant after-effects than other preparations of opium. Depressants should be avoided. When pain is moderate and not due to blood-clots, phenacetin, five grains every three hours for two or three doses, will be found useful. I have found antipyrin, five grains, with a teaspoonful of aromatic spirits of ammonia every hour for two or three doses, efficient. When the pain is severe and not due to retained clots, the following will answer well: Tincturæ opii deodoratæ, ℥i; chloralis hydratis, gr. xl; elixiris aromatici q. s. ad ℥i. Sig.: Teaspoonful in water not oftener than every four hours. (3) *The lochia:* The physician should not neglect to inform himself as to the amount and character of the lochia. Marked diminution or suppression or the presence of a putrid odor should lead to the suspicion of sepsis and a careful investigation. If the red color persists much longer than usual, it is probably due to subinvolution (page 708). The lochial stain in healthy cases is red in the center, gradually fading away toward the periphery. In cases of putrid lochia the circumference of the stain is well marked, while the color at the center is lighter. Familiarity with the sometimes heavy but not offensive odor should be cultivated in order to avoid mistakes. (4) *The external genitals:* Antisepsis of the external genitals has already been referred to (page 689). (5) *The bladder:* A frequent and annoying complication of the puerperium is the retention of urine, of which the causes have been noted (page 676). At his first visit the physician should satisfy himself by percussion and palpation as to the condition of the bladder. The use of the catheter should be avoided if possible and urination encouraged by the application of hot cloths to the abdomen and vulva, by small doses of ergot and the sound of running water, by tightening the binder or compressing the abdomen to reinforce the action of the lax walls. The patient may succeed after the first three days, by the cautious assumption of the sitting posture. The dangers of sitting up at this time have been very much exaggerated, and if the uterus is well contracted and the pulse not affected by the position it is probably preferable to the passage of the catheter. It should be remembered that the danger of cystitis from the passage of the catheter is decidedly increased after the second or third day on account of the beginning decomposition of the lochia. As a rule, the patient may be allowed to hold water for twelve hours if the uterus is well contracted and there is no danger of hemorrhage, and she should be encouraged in the effort to avoid the catheter. If its use becomes

inevitable, it should be passed with all aseptic precautions. The external genitals should be carefully cleansed, the region of the meatus should be sponged with a 1 : 4000 sublimate solution, and the catheter inserted under the guidance of the eye. A glass catheter should be used when possible, as it admits of perfect sterilization by boiling. It is a useful precaution for women during the last few weeks of pregnancy to become accustomed to urinating in the recumbent posture. (6) *The bowels:* A laxative should be given at the end of the first forty-eight hours. Castor oil, from one-half to one ounce, if not offensive, is preferable. Compound licorice powder is a good preparation. When the patient feels an inclination for a movement, it is well to soften the rectal contents by an injection of two or three ounces of olive oil or water, since owing to the bruises and small lacerations incident to labor, the passage of hard fecal masses is sometimes very painful. The same procedure is valuable in perineorrhaphy cases (Part X). A laxative may be given from time to time while the mother remains in bed, but if enemata are sufficient they are preferable. Many women are unable completely to empty the bladder or bowel by the use of the bed-pan, and resulting pelvic congestion and pressure are favored. The difficulty could have been avoided had the patient been trained in the use of the bed-pan during pregnancy. Another remedy for incomplete bladder or bowel evacuation, and a method which at the same time favors uterine drainage, is permitting the patient to sit upon the vessel placed in the bed or upon a commode at the bedside, early in the puerperium, for bladder and bowel evacuation. This has in the past been recommended by some in selected cases, and by others in all. In my observation during the past ten years on many thousands of cases confined in the tenements, I have never seen dangerous symptoms result from this practice, and yet the majority of patients within six or eight hours of their confinement either sat upon a vessel in bed or at the bedside to pass urine. (7 and 8) *The breasts and nipples:* The management of the nipples during the latter months of pregnancy in cases of deficient development has been mentioned (page 187). With the establishment of the milk secretion on the third day the breasts sometimes become the seat of painful distention, owing to the excessive secretion, and the relief afforded by putting the infant to the breast may not be sufficient to relieve the condition. One of the best methods to correct the overdistention is massage and milking the breasts through a piece of hot sterile flannel, the milk being allowed to flow into the warm flannel (Part VII) (Fig. 967). Breast-pumps are to be avoided if possible, but if used the action should be assisted by the nurse, who should gently compress the breast and massage it with the finger-tips from the periphery toward the nipple (Figs. 967, 968, 969). All rough handling should be avoided. Uniform compression and considerable relief may be afforded by the use of a breast bandage, with or without hot stuping (Fig. 972). If the distention is very great, it may be advisable to administer a saline cathartic and restrict the supply of liquids, milk included, for a time. The application of a hot lead and opium wash may afford relief, but great care should be taken when applying the child to the breast. Before and after each nursing the nipples should be carefully cleansed with a saturated solution of boric acid and covered with sterilized gauze without exercise of pressure. It is a useful precaution against cracks and fissures of the nipple to anoint the nipple and tissues about its base with sterilized sweet oil after each nursing. The importance to both mother and child of the proper performance of the function of lactation is universally admitted. Its favorable influences upon uterine contraction and involution and the subsequent prevention of uterine disease should never be forgotten.

If the child is still-born or dies subsequent to labor or it is necessary to wean for any cause the proper care of the breasts is important.

Of the various treatments proposed for controlling and drying up the milk secretion, I have been most successful with the following:

1. The application of a tight well-fitting breast binder, after the breasts have been lightly smeared with a solution of atropin sulphate in glycerin (gr. i to ℥j). This is repeated twice in the twenty-four hours.
2. The cutting-down of the liquid intake to a minimum.
3. The causing of free watery stools with saline cathartics.
4. The avoidance of all massage of the breasts or the use of breast-pumps if possible.

Should the breasts become very hard and painful, the application of hot flannel stupes, and the massaging out of the milk secretion through and into the stupes is permissible.

In the case of still-born children, and when the above treatment can be instituted before the filling-up of the breasts on the third day, stuping and massage are rarely necessary, and should be avoided if possible in any case.

4. Diet.—Individual characteristics must be considered, also the character of the delivery and whether it was accompanied with little or great loss of blood. A mixed diet seems to give the best results and may be begun on the first day. This form of diet causes the least loss of weight. During the first few days it is well to give a highly albuminized diet, and alcoholics should not be used except in the presence of collapse or weakness. Milk, wheaten and other forms of bread, soups, and well-cooked meats form the basis of the diet. Until the bowels have moved on the second or third day a light diet is advisable. Milk, milk-toast, soup, gruel, or clam-broth may be given. A small amount of tea may be allowed if the patient is accustomed to its use and desires it. Coffee is apt to cause insomnia. After the bowels have moved, the appetite of the patient may be trusted as a safe guide. The starvation diet is obsolete. In view of the amount of disintegrated tissue to be eliminated, it would seem that an excess of nitrogenous food is not indicated. Articles which cause constipation should be avoided. If the breast secretion is deficient, however, a liberal quantity of milk is the best remedy.

Diet-list After Normal Confinement. First Day or Two.

Liquids.—Milk, hot or cold; beef-tea, weak tea; beef-broth or chicken-broth; beef-juice; egg shake; clam-broth; simple soups and cocoa.

Solids.—Thin bread and butter; saltine or soda crackers; milk-toast; dry or buttered toast; dropped or soft-boiled eggs; any breakfast cereal thoroughly cooked.

After First Two Days.—Liquids as above with addition of coffee. *Solids:* Any breakfast cereal; scrambled, soft-boiled, or dropped eggs; broiled whitefish; lamb chop; beefsteak; roast lamb; broiled, baked, or creamed chicken; baked, mashed, or stewed potatoes; macaroni; celery; lettuce; fruits; fresh vegetables, such as peas, asparagus, and string-beans in season and in moderation; boiled or baked custard; curds and whey; wine jelly; simple puddings, such as rice, tapioca. *Avoid:* Nursing mothers should avoid whatever previously disagreed with them, and usually also pork, veal, corned beef, cabbage, turnips, cucumbers, corn, beans (canned and dried), vinegar, strawberries, and melons unless thoroughly ripe.

Sample Breakfasts.—(1) Any breakfast cereal; soft egg; tea. (2) Orange; cereal and cream; scrambled egg; tea or cocoa. (3) Cereal; broiled whitefish;

bread and butter; tea, coffee, or cocoa. (4) Lamb chop; stewed potatoes; toast; tea, coffee, or cocoa. (5) Orange; scrambled or dropped egg; minced chicken; graham bread; coffee.

Sample Dinners.—(1) Broiled or roast chicken; sweet potato; baked cup custard. (2) Roast lamb; mashed potato; macaroni; wine jelly. (3) Roast beef; celery; mashed potato; rice pudding. (4) Simple soup; chicken; stewed potatoes; baked cup custard. (5) Raw oysters with any of the above.

Sample Suppers.—(1) Creamed chicken on toast; milk or cocoa. (2) Oyster stew; bread and butter; cocoa. (3) Minced chicken on toast; baked apples and cream; tea. (4) Dropped eggs on toast; graham bread and butter; cocoa or tea. (5) Raw oysters with any of the above.

5. Posture and Duration of the Puerperium.—For the first few hours after labor the pillows should be removed and the head kept low to guard against the occurrence of cerebral anemia. For a day or two, and especially when the binder is not in place, the patient should on no account be allowed to turn on her side, for reasons stated (page 689). For the first two or three days the patient should remain quiet, lying on the back, which position is most favorable for the closing of the uterine sinuses, the healing of abraded surfaces, and escaping lochia. She should retain the recumbent position in bed until the uterus can no longer be felt by external palpation; that is, ten days or two weeks. The practice of keeping the patient on her back for all of this period is not to be recommended. It is unnatural and depressing, and tends to cause posterior displacement of the uterus, sacculation, and interference with drainage. After the first seventy-two hours the patient should be encouraged to turn first on one side and then on the other, and later to lie on the abdomen, and finally to sleep in this position. At the beginning of the third week the patient may be lifted into a reclining chair or on a sofa, and may sit up for a short time each day as her strength permits. After the fourth week she may go about the house or drive in the open air, but on no account should she resume her household duties or do any lifting, long standing, or walking until the period of involution is complete. The physician will not only do his duty to his patient, but will save himself subsequent reproach, by insisting on the observance of these rules, and he will find that every intelligent patient will submit willingly to restraint or inconvenience if he explain to her how largely her future health or even life may depend on care and moderation during the lying-in period. Getting up too soon, and especially too early resumption of household duties, are important factors in the production of displacements and even prolapse, particularly when delivery has been attended by some lesion of the pelvic floor which has been neglected or improperly treated. Patients even after leaving the bed should spend part of each day in the recumbent posture, and the occurrence of a backache should be regarded as a warning against standing or walking and against any kind of work. One reason why the puerperal woman is better for a considerable rest in bed after delivery, and why the same kind of rest is not necessary in the case of quadrupeds, is that in the erect posture natural to human beings the uterus and its appendages and the floor of the pelvis are subjected to a downward pressure which does not occur in a quadrupedal position. When the woman does not rest recumbent long enough after delivery, she is liable to many forms of uterine displacement, and her too early getting up may cause hemorrhage by dislodging clots from the uterine sinuses, or thrombosis may occur in the veins of the broad ligament with danger of embolism in the heart

or lungs. The duration of the rest in bed is variously given as seven, fourteen, to twenty-one days. The first is too short except in very unusual cases. A rest of two weeks followed by gradual resumption of ordinary activities is the usual period required. Involution of the uterus is not completed for a period of five or six weeks, but if a patient is kept in bed as long as that she loses flesh and strength and her appetite fails. When the patient first gets up, she should remain up only an hour or so in the day.

6. Prophylaxis in the Puerperium.—While we cannot be so aggressive in our methods in the puerperium as in labor, yet there is much that may be accomplished in the way of prophylaxis. The all-important question at this

FIG. 920.—PELVIC BINDER AND PELVIC FLOOR SUPPORT FOR USE AFTER THE PUERPERIUM.*—(*From a photograph.*)

FIG. 921.—PELVIC BINDER AND PERINEAL SUPPORT. POSTERIOR VIEW.

time is, How can we best secure involution in the puerperal state? It is during the puerperium that we should rivet our attention on the prevention of subinvolution, especially in cases following the premature interruption of pregnancy. Were closer attention given this subject in practice, the sequelæ of subinvolution—metritis, endometritis, retrodisplacements, and prolapse—would be less frequently met with.

(1) *The Abdominal Binder.*—The proper treatment of the relaxed abdominal walls after delivery is of great importance for cosmetic reasons and to prevent the results of pendulous abdomen. A certain amount of

*These binders may be obtained from the Home Bureau, 52 West 39th Street, New York City.

fixation is necessary for proper involution of the abdominal walls, and this is best secured by a binder. The binder tends to prevent atony and lack of contraction in the uterus, splanchnoptosis of the abdominal viscera, and obviates the danger of sudden filling of the abdominal veins due to the greatly lessened intra-abdominal pressure after confinement. The binder when properly applied conduces to the patient's comfort, especially by permitting her to assume the lateral position. It should not be applied too tightly, as this, combined with prolonged dorsal decubitus, tends to cause posterior displacement of the uterus.

(2) *The Pelvic Binder.*—After the patient begins to move about, the ordinary abdominal binder is with difficulty kept in place, and, moreover, by this time has pretty much served its purpose. At this time in all cases, but especially in those of undue pelvic-floor projection, and in patients with weak and overdistended abdominal walls (twins, hydramnios), I am accustomed to replace the abdominal with a pelvic binder, to sustain the pelvic floor and the antero-lateral abdominal wall for three months following the puerperium (Figs. 920, 921, and 922). The binder is made of muslin, linen, mull, canton flannel, or two thicknesses of heavy gauze, and, as the illustrations show, is made to encircle the pelvis and lower abdomen at a level with the crests of the ilia and to support the pelvic floor by a strap of the same material passing between the thighs, and, tightly drawn, is pinned in front or behind as convenient. Ordinary corset lacing down the front or back secures a snug fitting to the binder. The pelvic binder, when applied, laced, and the perineal band secured, is not unlike in appearance and shape the ordinary swimming trunks worn by bathers. I am accustomed to have half a dozen pelvic binders fitted and made in the latter part of the puerperium and to replace the use of the abdominal binder with them as soon as the lochia has practically ceased in the third week, when the patient first commences to sit up in bed or changes from bed to lounge, and to continue its use for three months from that time. The results obtained by the use of this support have been more than satisfactory. It is appreciated by the patients themselves, some having used them after four confinements. (1) It prevents or corrects undue sagging of the pelvic floor. This is especially noticeable in cases in which during labor the levator ani muscle has been subjected to severe or prolonged pressure, severe lacerations with bad union, and in which the levator ani is torn, the perineum remaining intact. (2) It assists in the ultimate union of severe lacerations of the pelvic floor which have been repaired. (3) It preserves the woman's figure after confinement by its support of the lower anterior abdominal wall and the pelvic floor. (4) It lessens the danger of displacement of the pelvic contents. (5) It tends to prevent pelvic congestion. (6) It usually adds to the comfort of the patient, giving her a feeling of security and well-being and allowing her to obtain needed exercise earlier and more freely than would otherwise be the case. Unless preexisting pelvic disease is present, with the use of this pelvic sup-

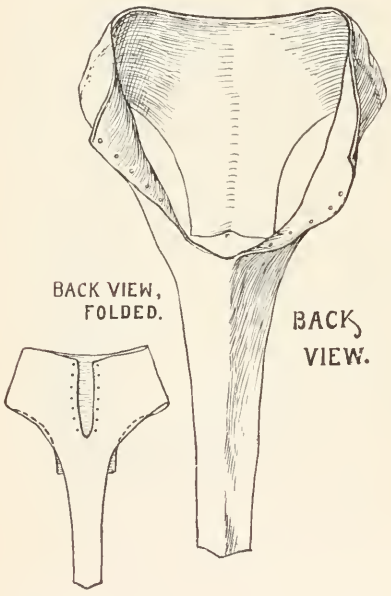

FIG. 922.—PELVIC BINDER AND PERINEAL SUPPORT, SHOWING SHAPE.

port we rarely see the danger signals of pelvic congestion—backache and irritable bladder; and the complex nervous manifestations of splanchnoptosis in general and of gastroptosis, nephroptosis, and enteroptosis in particular.

(3) *Medication.*—What place have drugs and various non-medicinal methods of treatment of the puerperium in the prevention of subinvolution and subsequent gynecological conditions? During the past ten years I have experimented with various methods of managing the puerperium with the object of determining, if possible, the best treatment for the prevention of subinvolution and subsequent gynecological conditions. Ergot, quinine, repeated hot vaginal irrigations, apparently have no effect in hastening uterine involution. The best results were obtained with (1) strychnin administered both during the

FIG. 923.—BREAST SUPPORT FOR NURSING WOMEN.—(*From a photograph.*)

FIG. 924.—INDIA GAUZE BODICE USED AS BREAST SUPPORT.—(*From a photograph.*)

latter part of pregnancy and during the first ten days of the puerperium; (2) rotation of the patient as regards posture during the lying-in state; (3) early use of the vessel in bed or the commode at the side of the bed, favoring drainage and avoiding pelvic congestion.

(4) *Massage and Exercise.*—Massage, including dry friction of the skin of the whole body, general massage with deep manipulations, kneading and deep rubbing, local massage of the abdominal viscera, through the abdominal walls, and exercises, including principally passive and resisted movements of the extremities, are valuable therapeutic agents in the prevention of subinvolution of the uterus and abdominal walls, and splanchnoptosis with its attendant digestive, circulatory, and nervous phenomena. Like other remedial agents, such measures are to be used with care, and are not applicable to all

cases alike. Stimulation of the cutaneous circulation by dry friction with the hand or Turkish glove or by an "alcohol rub" can generally be used with advantage after the first day of the puerperium. In the absence of complications, general massage with deeper manipulations, kneading, and rubbing can be gradually introduced toward the end of the first week if the lochia is not increased thereby, and in the second week gradually increasing passive and resisted movements of the extremities may be added. All forms of septic infection, but especially the thrombotic variety, are contraindications to the use of anything more active than surface stimulation.

(5) *The First Use of the Corset.*—It is especially important in the first use of the corset that a properly fitting garment be employed. At this time especially should the corsets which exert a downward pressure into the pelvis, and form excessive pelvic floor projection, retrodisplacement, and prolapse of the uterus, be avoided. Corsets made to support the lower abdomen with an upward and backward pressure should be used (Figs. 36 and 37).

7. The Examination of the Puerperium.—The importance of routine examination of the pelvic contents and noting the tonicity or sagging of the pelvic floor (levator ani muscle) at the completion of the puerperium cannot be overestimated. If this is made a routine, many minor derangements could be corrected, which, if untreated, would become aggravated by time. A routine physical examination of every woman toward the close of the puerperium and before she passes out of the observation of the obstetrician is of the greatest value in detecting departures from the normal process of involution and in drawing attention to them when they are amenable to treatment. Were some simple, orderly method of history-keeping in obstetric cases in private practice adhered to, this examination in the puerperium would readily become a routine and give us valuable records for subsequent reference. (See Appendix.) The following observations should be made: (1) Height and position of the fundus uteri; (2) condition of the breasts and nipples; (3) condition of the pelvic floor, perineum, and ostium vaginæ; (4) quantity and quality of the vaginal discharge; (5) position, sensibility, and mobility of the uterus; (6) condition of the adnexa and perimetrium and parametrium; and (7) general condition of the patient.

PART SEVEN.

Pathological Puerperium.

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XI. BLOOD CONDITIONS. (Page 768.) 1. Thrombosis and Embolism. 2. Hematoma. 3. Anemia.

XII. DISEASES OF THE NERVOUS SYSTEM. (Page 769.) 1. Lesions of the Sacral Plexus. 2. Puerperal Neuritis and Paralyses. 3. Hemiplegia and Aphasia. 4. Myelitis and Paraplegia. 5. Puerperal Insanity.

XIII. SKIN DISEASES. (Page 773.)

XIV. GENERAL DISEASES. (Page 773.)

XV. SUDDEN DEATH. (Page 773.)

I. PUERPERAL HEMORRHAGES.

Definition.—Puerperal hemorrhages are those occurring any time from twenty-four hours after the completion of the third stage of labor until the period of involution is complete, namely six weeks. They are also called secondary or late hemorrhages.

Frequency.—Puerperal metrorrhagia depends largely upon the management of the third stage of labor, and the care that the puerperal woman receives during the first few hours of the lying-in stage. Secondary hemorrhage is not nearly so frequent as the primary post-partum hemorrhage. The amount of lochia varies in different patients. In some the duration of the lochial discharge is longer and its quantity greater than in others, and still it is not abundant enough to amount to a secondary or remote post-partum hemorrhage. True secondary hemorrhage is generally sudden. The quantity of blood varies and the bleeding may cease for a time and then recur. As in primary post-partum hemorrhage or flooding, so in the secondary variety, the hemorrhage may be entirely unlooked for, and may occur suddenly without premonitory symptoms of any kind. The first sign is the external flow of blood. The abruptness of its onset may preclude any opportunity for consultation, and if previous preparation for such an emergency has not been made, the result may be fatal. Besides the hemorrhage, there is often a fetid discharge resulting from decomposition of the retained parts. There may also be septic symptoms, which will offer an additional diagnostic point.

Etiology.—The causes of secondary hemorrhages may be conveniently divided into *general* and *local*. Among the *general causes* may be classed: (1) Disturbances of the general circulation, such as occur in certain abnormal conditions of the heart, lungs, or liver, and result in the damming back of the blood into the pelvic vessels, or from the overuse of chloroform or stimulants; (2) acute infectious diseases; (3) peculiar blood conditions, as in puerperal fever, albuminuria, and general malarial poisoning; (4) mental emotions, surprises, shocks, joy, anger, fright, such as fire in the immediate neighborhood, explosions, or sudden approach of an intoxicated husband, producing vasomotor changes or a relaxation of the uterus. Among the *local causes* are: (1) Uterine relaxation; (2) retained placenta or membrane; (3) retained blood-clot; (4) a secondary placenta; (5) secondary hemorrhage from lacerations of the cervix, vagina, or vulva; (6) active pelvic congestion; (7) displaced thrombi; (8) metritis; (9) fibromata; (10) hematomata; (11) carcinomata; (12) uterine displacement; (13) distended bladder or rectum.

1. Simple uterine relaxation is of rare occurrence as a cause of puerperal hemorrhage. It rarely occurs after the third day of the puerperium, and is usually caused by the retention of debris in the uterine cavity or by a defect in the control of the nervous system.

2. Retained placenta or membrane results from careless management or an incomplete third stage of labor, and may usually be prevented by careful examination of the placenta and membranes at the time of labor, and removal

of retained fragments. Small pieces of retained membrane, it should be remembered, do not necessarily produce puerperal hemorrhage. This is the most important cause of secondary hemorrhage as well as the most frequent. Such a retention may be suspected if the lochial discharge is normal in amount and character at first, but becomes profuse and amounts to an actual hemorrhage after ten or fourteen days. The detachment of the retained placental fragments is apt to open one or more of the uterine sinuses.

3. Retained blood clots are common in multiparæ and may be prevented by careful watching of the uterus for one hour after the completion of the third stage. They are often secondary to retained placenta and membranes and to uterine displacement. The clots can usually be expelled by Credé's method.

4. Secondary placenta, when it exists, may in like manner produce hemorrhage.

5. Secondary hemorrhage from lacerations of cervix, vagina, or vulva. Milder cases may be treated with plain hot water or acetic acid (two per cent.); more severe bleeding requires ligation. (See Part X.) The lacerations in the perineum and vulva are generally apparent, but sometimes those in the vagina are not visible without special examination. Tears of the cervix sometimes extend to the vaginal fornix and at times through a venous sinus.

FIG. 925.—FIBRINOUS POLYPUS OF THE PUERPERAL UTERUS.—(*Fränkel.*)

6. Active or passive pelvic congestion. Active pelvic congestion may be produced by moving about too soon after labor or by too early sexual intercourse. Passive congestion may result from subinvolution, increasing and prolonging the red lochia, or may be due to obstruction to the return circulation; or it may come from varicosity of the pampiniform plexus or from disease of the adnexa. General diseases in this connection have been noted above. (See Postpartum Hemorrhage.)

7. Displaced thrombi may occur primarily as the result of rapid heart action and high arterial tension following labor, or secondarily from septic disintegration of thrombi formed in the uterine sinuses. This accident may also occur from sudden strain, or from turning in bed or sitting up.

8. Metritis. This inflammatory condition of the uterus sometimes makes it prone to bleed easily. (See Metritis, page 730.)

9. Fibromata are liable to cause excessive and prolonged red lochia and may produce violent hemorrhage. Mucous polypi may also have the same effect (Fig. 925).

10. A hematoma is an internal, interstitial, or concealed hemorrhage, which may be submucous, subcutaneous, or subperitoneal. As a rule, it does not require treatment.*

11. Carcinoma is usually seated in the cervix and may require curettage and packing. Malignant disease of the uterus, as a rule, hinders or prevents conception, consequently this condition is rare.

* See N. Y. Obstet. Soc., April, 1901.

12. Uterine displacement may be caused by overdistended bladder, prolonged dorsal position, getting up too early, or sudden effort on the part of the patient. Backward displacement is the most common. The heavy uterus is in a condition to be easily displaced and the direction varies widely. Any cause hindering the normal involution of the uterus tends toward this result. Immediately after labor the uterus is freely movable, and confinement of the patient to one position or the imperfect application of binders is most injurious. An abnormal flexion of the uterus will cause a retention of the secretions until the occurrence of putrefactive changes. Immediately after labor the normal position of the uterus is increased anteversion with a slight prolapse. When inversion takes place, it is usually very soon after labor, and may follow some severe strain. It must be differentiated from a polypoid tumor. Retroflexion or retroversion is often caused by the application of a tight binder before the uterus has returned to its normal position below the pubis, the pressure on the abdomen forcing the organ backward. Subinvolution from any cause may produce this anomaly. Prolapse may occur from great straining, especially when labor has been attended by marked injuries.

13. A distended bladder or rectum, especially the former, may act as a cause (Fig. 926).

Symptoms.—These are general and local, the former being those characteristic of hemorrhage in general—pallor, weakness, dimness of vision, small, thready pulse, tendency to syncope, cold perspiration. The local symptoms are a softened condition of the uterus and an internal and external hemorrhage, although at first the latter may not appear.

Prognosis.—The amount of hemorrhage may vary within wide limits and the loss of blood may occur gradually or in a sudden gush. The great danger from puerperal hemorrhage lies in the opportunities for infection, which always threatens the puerperal woman, since the gaping vessels afford such an easy port of entry to septic products.

Treatment.—This must vary with the cause. As in primary hemorrhage, the best treatment is *preventive*. All the general and local causes of the accident should be prevented, or if present they should be corrected. The lying-in woman should be protected against (1) mental emotions; (2) disturbances of the general circulation; and (3) blood conditions that might cause a hemorrhage during the puerperal state. If the third stage of labor, as well as the first few days of the puerperium, is properly managed there will be avoided (1) the retention of placental tissues, (2) of membranes, and (3) of blood-clots, and (4) a distended bladder or rectum. The patient should be kept quietly in bed till involution is complete and sexual intercourse should be prohibited for two months. The *curative* treatment of this condition consists, as in primary hemorrhage, in making sure that the uterus is completely emptied, and in securing complete contraction. A vaginal examination should always be made, and, if the cervical canal allow it, the uterine cavity explored and any retained material removed. If the cervix will not allow of the passage of the finger and the hemorrhage is profuse, the canal must be dilated and the interior of the uterus examined. Should the evacuation of the uterus not stop the bleeding, its interior should be swabbed out with a 2 per cent. acetic-acid solution—or the plan of irrigating the uterus with hot water at a temperature of 110° F. may be tried. The contracted state of the cervix may prevent the proper outflow of the water, and this must be guarded against by using a small intrauterine tube or return-flow tube and first securing ample dilatation of the cervical canal. If there are symptoms of septicemia, creolin injections are

excellent. Ergot, one to two drachms, with tincture of cannabis indica fifteen minims, is indicated and may be repeated as necessary. Rest, both physical and mental, must be insisted upon, while tonics and a nutritious liquid diet will be subsequently needed. If relaxation of the uterus is the cause, packing the uterine cavity with gauze is the best treatment. (See Part X.) This is also used in the case of sepsis or displaced thrombi. And here the curette must not be employed. Uterine polyps should be removed. Faradism is of some value. A hard bed and a cool room should be provided, and the rectum and bladder should be emptied by enema and catheter if necessary.

1. **Hematoma of the Vagina and Vulva.—Definition.**—An extravasation of blood into the subcutaneous and submucous tissue of the vulva, extending in some cases into the perineum as far as the anus, or into the paravaginal tissue as far as the abdominal cavity. **Etiology.**—The predisposing factor is the vascularity of the tissues in the pregnant state, with the varicosity of the pudendal veins. Exciting causes are usually connected with delivery, as in manual and instrumental extraction. Since the fetal head exerts a hemostatic action during its birth, the hematoma becomes in evidence, as a rule, during the third stage of labor. Sometimes it happens that the extravasation precedes labor as a result of some act of violence. In twin pregnancy it is not uncommon to see a hematoma follow the birth of the first child, and constitute an obstacle to the passage of the other twin. **Pathology.**—The extravasated blood tends to coagulate at once, and the hemorrhage usually becomes arrested before it becomes extensive. The oozing, as a rule, ceases after two or three hours. Exceptionally, hemorrhage continues intermittently for a much longer period. The tendency is toward resolution, effected by gradual absorption, which is completed in four or five weeks. Rupture often occurs, especially when the hematoma precedes the second stage of labor; there is then danger of infection. **Symptoms.**—The extravasation is accompanied by pain, which varies greatly in degree and kind. A tumor forms rapidly, usually on one side of the vulva, having a dusky or livid color. As a rule, some tenesmus of the bladder, rectum, or both coexists. If the extravasation is in the paravaginal tissue alone, no external tumor is apparent. Non-appearance of the lochial discharge should suggest such an accident. **Diagnosis.**—The tumor when suspected is mapped out by inspection and by digital exploration of the vagina and rectum. Since there is always a zone of edema about the extravasation proper, an edematous area may conceal a small hematoma. Hematoma has been mistaken for a variety of conditions, such as inversion of the uterus, cysts of the vagina, etc. **Prognosis.**—At the present antiseptic period this is favorable, but even to-day the mortality is computed at 12 per cent. The chief cause of death is profuse hemorrhage, which is usually the result of rupture of a vaginal hematoma which precedes the second stage of labor. The likelihood of a fatal hemorrhage is fully as great here as in placenta prævia. **Treatment.**—In hematoma antedating the second stage of labor, interference despite the danger of rupture, is con-

FIG. 926.—HEMATOMA OF VAGINA AND VULVA. —(*Hill.*)

traindicated, unless the tumor actually obstructs the birth of the child. The mass should then be incised and the clots extracted. The cavity should be packed with gauze after securing all bleeding vessels. In very large hematomata, which threaten to rupture spontaneously in the puerperium, from the effects of pressure, incision and packing should also be practised. Under all other conditions, treatment should be expectant. Pressure and cold applications should be used to arrest further hemorrhage and promote absorption.

II. INTESTINAL ANOMALIES.

1. **Constipation.**—This is the rule in the puerperium, and is caused by weakened musculature of the abdominal parietes and intestinal muscle-coats and by the prolonged rest in bed. This condition often causes fever, possibly from the absorption of animal alkaloids. Evacuation of the bowels should occur by the end of the third day (unless there has been a complete suture of the perineum, when treatment should be deferred until the fourth day), and the administration of laxatives during this period is not necessary if the bowels were well opened before labor. But if no movement occurs in this time and diet seems to have no effect, it is well to try a simple injection of water, to which a little glycerin may be added. For not only the mother's condition must be taken into consideration, but, if she nurses her child, the latter demands equally careful consideration. If the injection is not effective, castor oil, calomel, a saline laxative, or the well-known combination of aloin, strychnin, and belladonna may be given. The regular action is then generally established, although an obstinate constipation may persist which will demand much skill to overcome.

2. **Tympanites.**—There sometimes occurs in neurotic women an excessive amount of gas in the intestines following a sudden paralysis of their musculature. The abdomen is greatly distended, so that there may be true orthopnea from upward pressure of the diaphragm, and there is obstinate vomiting with persistent constipation and other signs of obstruction of the bowels. There are no symptoms of peritonitis, but there is a serious outlook for the patient's life, demanding radical treatment. Nerve sedatives, large hypodermic doses of strychnin, enemata of asafetida and turpentine, and gentle cathartics by the mouth are all indicated. If these measures fail, the rectal tube and high enemata may be used.

3. **Hemorrhoids.**—Pregnancy may cause such a degree of congestion of the rectal veins that it may persist after labor. This condition may show itself only during the period of parturition or it may persist afterward. The pain is very severe. Ulceration and gangrene may result. In treating this condition the bowels must be kept regular, and either hot or cold local applications will relieve the pain. Astringent, sedative suppositories sometimes give relief, as belladonna, opium and lead, and compound ointment of gall. If strangulation occurs, the tumors must be excised.

III. URINARY ANOMALIES.

1. **Hematuria.**—This condition in the puerperium generally follows a hemorrhoidal condition of the vesical veins induced by pelvic congestion in the last part of pregnancy. It may be due also to injury from pressure of the child's

head or from instruments or the result of vesico-vaginal fistulæ. The differential diagnosis may be made from the history. Blood when present in the urine generally disappears spontaneously in a few days, but occasionally astringent injections are necessary. Unusual care should be observed at this time in the use of the catheter.

2. Incontinence of Urine.—Incessant dribbling may be due to paralysis of the sphincter or to fistulæ. If the urine escapes involuntarily soon after delivery, an examination should be made at once. If there are also present severe abdominal pains and the urine escapes a few drops at a time, or with an occasional gush or spurt, there will be grounds for the diagnosis of incontinence of retention. Examination will reveal a median abdominal tumor having a dull percussion note. The catheter will empty the bladder and relieve the distention. If, however, there is no pain on the escape of urine, and if labor has been abnormal, a fistula will probably be discovered. When this is very small, it may heal spontaneously. But if this is impossible, a plastic operation may be necessary later. Rarely pressure paralysis of the vesical sphincter and the urethra may be the cause of this trouble. Such cases sometimes do not seem amenable to treatment of any kind, though tonics, electricity applied to the urethra, and massage may be successful.

FIG. 927.—RETENTION OF URINE AND DISTENDED BLADDER DURING THE EARLY PART OF THE PUERPERIUM.

3. Retention of Urine.—After labor retention of urine is very common, and, indeed, may be expected for a few hours. This is caused by the expansion of the bladder and its loss of sensibility after the uterus has expelled its contents, and often by the cessation of action of the abdominal muscles. There may also be a real obstruction from traumatism of the urinary apparatus, especially the urethra. Before resorting to the use of the catheter, which is always attended with some risk of bladder infection, all other known means for relieving the condition should be tried, as the sound of running water, allowing a stream of warm water to flow over the vulva into a douche pan, the application of hot chloroform stupes to the vulva, and, if not contraindicated, allowing the patient to assume the sitting posture in bed on the vessel or douche pan. If this last procedure is permitted in the first twenty-four hours of the puerperium, the nurse should be instructed carefully to watch the fundus uteri during the evacuation of the bladder. Whatever the cause, a period not longer than eighteen hours should be allowed to pass before the patient is catheterized, and in this operation all possible antiseptic precautions should be taken. Retention is most common after suture of the perineum. The bladder may be injured

by retention and uterine hemorrhage occur from the excessive distention of the organ. (See Puerperal Hemorrhage, page 701.) (Fig. 927.)

4. Cystitis.—This is unfortunately quite common in the puerperium and is a serious affection of the urinary system to be guarded against, since it may lead to a fatal result. Frequently it does not pass beyond the mild form, and its duration is then only transitory. *Etiology:* The common cause is careless introduction of the catheter. This should always be done under the strictest antiseptic precautions. The urethral orifice should never be shielded by the bed-sheet, but ought in all cases to be perfectly exposed to the view of the operator. Again, though rarely, overdistention of the bladder or pressure of the child's head may injure the vesical walls sufficiently to cause a catarrhal cystitis. This type is generally of short duration unless an introduction of micro-organisms takes place. Under these circumstances the simple lesion may develop into a suppurative inflammation which does not limit itself to the bladder, but extends along the ureters to the kidneys and ends in disease of these organs. Even when the catheter is not used there may be migration of vaginal micro-organisms into the urethra, and, according to some authorities, micro-organisms from the various pelvic viscera may find their way into the bladder. *Symptoms:* The symptoms of the milder type are those of an ordinary cystitis: viz., frequent urination, discomfort, burning pain, and alkaline urine. With the development into the septic form, the symptoms increase in severity, especially with the extension of the disease to the ureters. Sometimes delirium occurs, the temperature is high, and anemia and prostration are extreme. The constant desire to urinate gives rise to great distress. The condition of the bowels is quite variable.

Urinary examination shows the amount to be small, the specific gravity low, reaction acid. The microscopic examination reveals epithelium of several varieties, pus- and blood-corpuscles, urates and uric acid crystals. The mucous membrane may exfoliate and pass off in the urine. In such severe cases the presence of albumin and tube casts will be detected. The *prognosis* of this affection will depend upon prompt attention and careful *treatment.* The great danger lies in extension to the kidneys. Prophylaxis is most important. After its occurrence the bladder should be irrigated several times a day with boric-acid solution; creolin, 0.5 per cent., or sublimate, 1 : 20,000, is sometimes used. The internal administration of salol, urotropin, boric or benzoic acid and buchu is also advisable, as these drugs affect the quality of the urine. The patient's strength and general tone must be kept up by tonics and stimulants as well as by nourishing food. Subsequently change of climate is often beneficial.

5. Pyelonephritis.—This may occur from the extension of the vesical lesion along the ureters to the pelvis of the kidney. There are cases in which the bladder trouble is so slight that it is not noticed, and it is only the lighting-up of the renal inflammation that draws attention to the disturbance. This infection may also be caused by the irritation of renal calculi or may occur from the blood. The prognosis is doubtful, many cases ending fatally. The treatment is essentially the same as in cystitis, with the addition oftentimes of incision of the pelvis of the kidney or of the perinephritic abscess, in case the latter develops. Post-mortem examination has shown the kidney to be involved as a whole, forming a large bag of pus, or to be honeycombed throughout with tiny abscesses.

IV. ANOMALIES OF THE GENITAL TRACT.

1. **Subinvolution.**—Subinvolution is a retarded or incomplete involution of the uterus. The normal process requires generally from six to ten weeks. *Pathology:* The process of involution is one of fatty degeneration, absorption, and atrophy. It is not believed that the whole muscle cell is destroyed by fatty degeneration, but rather that atrophy accompanies the fatty process and ceases after the muscle fiber reaches its original size. The uterine adnexa, vagina, and vulva undergo the same process. (See Part VI.) It can readily be seen how slight influences, either acting directly on the uterus or through the mother's blood, can interfere with the process of involution, resulting in the pathological condition known as subinvolution. Arrested involution depends entirely upon changes in the circulation of the uterus or its vicinity; congestion, either active or passive, being the important etiological factor. *Etiology:* (1) Causes interfering with the proper contraction and retraction of the uterine muscle or with its blood-supply must be looked for as originating the condition of subinvolution. As a rule, these causes are local, though there are a few exceptions. Among the local causes may be mentioned: habitual distention of the bladder or rectum, retained secundines, displacement of the uterus, fibroid or polypoid tumors, or old peritoneal adhesions. (2) Causes either increasing the blood-supply to, or obstructing the return flow from, the uterus are: inflammatory conditions subsequent to septic processes, fibroid and other pelvic tumors, retained hypertrophied decidua as in incomplete abortion. Endometritis from other causes, cardiac and pulmonary disease, inflammatory conditions interfering with pelvic circulation, and all the causes of obstructed portal circulation also belong under this head. Nervous disorders, such as puerperal insanity or a great shock, not infrequently retard involution. Too early sexual intercourse after abortion or delivery may not only hinder but arrest involution. Women who do not nurse their children are more prone to this abnormality. It has been held by some that constitutional disturbances having no connection with any local cause may furnish the etiological factor. The local cause, however, should always be carefully looked for. *Diagnosis:* An early diagnosis is important, in order to avoid the numerous disorders which are so likely to follow subinvolution. Abdominal palpation will detect approximately any defect in the involution of the uterus; later, however, the diagnosis is generally made by the gynecologist. The uterus is large, boggy, soft, and tender on pressure. The size of the organ does not correspond to the period of the puerperium. *Symptoms:* These include a feeling of weight in the pelvis, lochia profuse and red, or serous lochia changing to bloody lochia late in puerperium, backache, reflex symptoms, pain or tenderness over the lower portion of abdomen. Irritable bladder or rectum may be present if acute displacement exists. *Treatment:* The *prophylactic treatment* of subinvolution is most important to save the pelvic organs from various subsequent gynecological conditions. (See Management of the Puerperium, Part VI.) *The curative treatment* must depend upon the cause. If this is retention of placental or decidual tissue, the uterus should be curetted and disinfected. If there are lacerations of the cervix or vagina, they will have to be repaired. Displacement of the uterus should be remedied by a suitable pessary, which is to be changed from time to time as the organ decreases in size. A pelvic tumor may be removed. The general functions of the body must be maintained by hygienic measures. Massage of the uterus may assist

it to return to its natural size. When the amount of lochia is excessive, hot vaginal douches should be given. The pelvic viscera should be depleted by hot injections and vigorous catharsis. Ergot is sometimes employed when it seems especially indicated by muscular weakness or the presence of small fibroids. Tonics and electricity are at times beneficial.

2. Superinvolution, Hyperinvolution.—A condition known as *superinvolution* or *hyperinvolution*, depending upon a prolongation of the fatty degeneration and atrophy of the parturient uterus, has been known to exist. It is very infrequent. In very rare cases the uterus may almost disappear. It is probably the result of profound anemia; protracted lactation may coexist. The *symptoms* are usually not pronounced. Menstruation may not return. Diagnosis should be made by bimanual examination. For *treatment*, the child must be weaned, tonics administered, the diet made nutritious and generous, and hygienic measures instituted, such as a change of air and scene, with massage or carefully regulated exercises.

3. Atrophy of the Uterus during Lactation.—This condition is not to be confounded with hyperinvolution, which is pathological in character. I mean

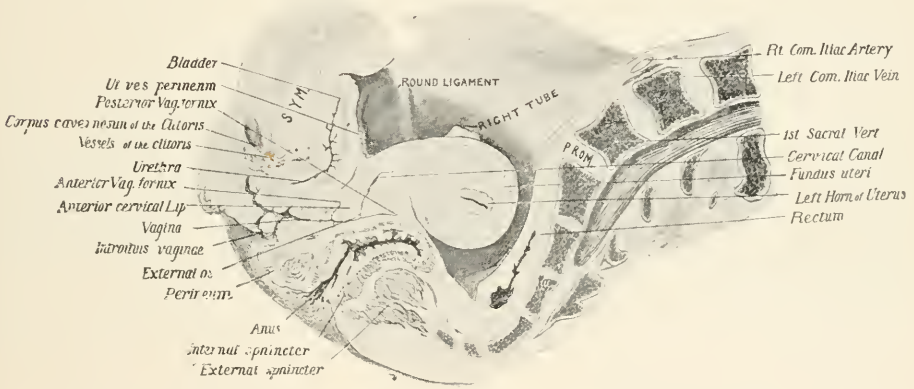


FIG. 928.—RETROFLEXION OF THE PUERPERAL UTERUS IN A MULTIPARA.—(*Sellheim.*)

by lactation-atrophy a physiological phenomenon which appears to be due chiefly to nursing alone. This subject, rarely mentioned by obstetricians, has been described by Vineburg.

It is known that in connection with involution the uterus becomes smaller at one period than even the non-parous organ; and that it undergoes regeneration either during or after the lactation period. The period of minimum size has been placed by various authorities at any time between six and twenty weeks. This phenomenon is best seen in the multipara, and is much less marked in primiparæ. Although known as lactation-atrophy, something of the same sort is seen in mothers who do not nurse their children, although in a much less degree.

If the uterus is studied microscopically during this period, the muscular fibers are seen to have undergone atrophy, while the usual fatty changes of involution are also in evidence. The part played by the ovaries in this connection is not known. In very high degrees of lactation-atrophy there should be a suspicion that the ovaries are in some way involved. A normal condition should not give rise to pathological symptoms, yet during this stage of minimal

size the patients almost always complain of backache and vague pelvic pains. Other symptoms, such as leucorrhea, are absent, this going to show that the condition is not necessarily pathological.

A typical case gives the following clinical picture: A woman during the lactation period develops backache and pelvic pain, without leucorrhea or other symptoms. Examination shows an undersized uterus. Although this atrophy is physiological and should be succeeded by regeneration, cases are not wanting in which the latter does not set in. The condition then may become permanent, but differs from hyperinvolution, through the fact that weaning the child may be followed by recovery. As a prevention it has been suggested that weaning should occur after the seventh month, in order to save the uterus from damage.

4. Uterine Displacements.—(1) *Inversion.* (See Pathology of Labor, page 590.) (2) *Prolapse:* The degree of this displacement varies to a great extent. When the injuries during birth have been severe, some great strain during the puerperium, such as lifting a heavy weight, causes occasionally a prolapse of the puerperal uterus. The latter is greatly increased in weight and deficient in muscular tone, both conditions favoring displacement. (3) *Retroflexion and retroversion* (Fig. 928): Retroflexion and retroversion are most commonly found in women who have suffered from these displacements before conception and in those who have aborted. A sudden strain, failure to empty the bladder when the desire is felt, and the use of tight binders, as noted before, may all contribute to these forms of displacement. These patients should stay in bed longer than usual and they should lie on the side as much as possible. In the latter part of the puerperium astringent douches should be given. (4) *Anteflexion and anteversion:* Extreme anteversion or anteflexion may also occur in the puerperium; the latter especially will cause a retention of the uterine secretions. Other abdominal organs are also sometimes displaced during the puerperium; floating kidney may be mentioned as an example.

V. ANOMALIES OF THE PELVIC ARTICULATIONS.

The joints affected are the symphysis pubis and sacro-iliac synchondroses. The cause is sometimes pathological change, sometimes the violent use of the forceps, or a combination of the two. These joints, as has already been noted, become relaxed in normal pregnancy so that they allow a slight amount of movement of the bones on one another. Various etiological factors are mentioned by different authorities, besides those noted above, among which are extreme exertion on the part of the patient, pressure of a large fetal head, and traumatism, which may cause inflammation. There is hyperemia and swelling of the synovial membrane and an increased secretion of the synovial fluid until the extremities of the bones become separated from each other. If this condition becomes more serious, the formation of pus takes place and abscess develops. The bone is gradually eroded and even becomes carious. Complete rupture of the joints of the pelvis may occur. *Symptoms:* These are noticed when the patient first gets up and tries to walk. There is pain, extending into the lower extremities, and increased mobility of the articulations. The latter fact can be proved by manual examination. The patient probably walks with difficulty. However, there may be considerable movement and little impairment of walking, or there may be slight movement only, with

much pain and lameness. The gait is very like that of the osteomalacic patient. In case of suppuration the symptoms are greatly intensified, chill and fever come on, abscesses of the soft parts develop, and the patient becomes unable to move the legs. Relapse is not unlikely to occur in the next pregnancy. In rare instances septicemia or pyemia results. *Diagnosis:* This is easily made from a few characteristic symptoms. The pain can always be exactly located by the patient in the diseased joint. There is tenderness on pressure or motion. The usual symptoms of suppuration indicate its presence. The *prognosis* is favorable in simple cases, but increases in gravity with the development of suppuration. *Treatment:* Rest in bed in the dorsal position and a strong, firm bandage, whose upper border is level with the iliac crests while the lower reaches just below the trochanters (Fig. 919). The patient may then walk around as she would ordinarily, even if there is pain. The condition generally terminates in recovery, the bones becoming fixed after some months, but, in a very few cases, this does not happen and the bandage has to be worn continuously. When the pain is severe, the ice-bag is indicated. Narcotics may also be given. The disease may become chronic, and in that case change of climate, sea-bathing, mild counterirritation, and continuous tight bandaging may be efficacious.

VI. DIASTASIS OF THE ABDOMINAL MUSCLES.

In patients whose abdomens have been unusually distended or whose abdominal muscles are weak, and especially in those who have borne many children, the recti are not infrequently separated. This condition sometimes allows the protrusion between the muscular borders of part of the abdominal contents, with the resulting symptoms of hernia. If properly reduced, the intestines may be quite easily held in place by means of a suitable bandage, and an operation subsequently performed.

VII. MORBIDITY IN THE PUERPERIUM.

Since the general adoption of asepsis and antisepsis by obstetricians severe puerperal morbidity has become of too infrequent occurrence for a single observer to be personally familiar with all its phases. As a natural result, the descriptions of these affections in standard works contain many contradictions, and it is by no means easy to obtain definite ideas as to the various manifestations of infection and intoxication occurring in the puerperium. The data accumulated by Lenhartz, in his great monograph on septic affections, are by no means in harmony with the teaching found in the leading text-books on obstetrics. I have therefore tried to subject the entire matter of puerperal morbidity to a careful analysis, based upon the latest authoritative data and my own clinical experience, and to classify and describe the various types of disease in such a way as to eliminate some of the sources of contradiction and confusion.

Frequency of Morbidity in the Puerperium.—The usual rough test between a normal and a pathological puerperium is furnished by the temperature. If the latter is over 100.4° F. (38° C.) in the axilla, the case is enumerated under morbidity.

The morbidity of the Paris clinics is shown by the following figures compiled by Budin: Charité, 1891–1894, 10.7 per cent.; Maternité, second half of 1895, 12.8 per cent.; 1896, 10.6 per cent.; 1897, 10.6 per cent.; Tarnier's clinic, 1898, 8.93 per cent.; 1899, 12 per cent. These figures make the average morbidity nearly 11 per cent. The statistics of some of the leading German clinicians are as follows: Merman, 6 per cent. fever of over 100.4° F. (38° C.); Leopold, considerable variation from year to year, limits from 8 to 20 per cent. approximately, average 14.6 per cent.; von Szabo, 19.75 per cent.; Zweifel, 17.4 per cent.; Hofmeier and Steffeck, 8.5 per cent.; Madlener, 18.6 per cent.; the average morbidity in these German clinics is therefore a little over 14 per cent. Ahlfeld, who has collated figures from many clinics, finds that the morbidity varies from 9 to 54 per cent. Such fluctuation appears to show that differentiation between puerperal and other fevers is very difficult.

Sellheim believes that high and persistent temperature occurs in about 2 per cent. to 4 per cent. of institutional cases. In an analysis of 2200 cases of confinement I found that a rise of temperature to 100.4° F. (38° C.) or over took place in 405 cases, or 18.45 per cent. In 204 cases the fever continued but a few hours, there being but a single elevation, and in only 72 of the 405 cases did the fever last for more than three days. In the 405 cases of fever the rise of temperature was:

Due to constipation in	259	cases, or	63.95	per cent.
" " reflex irritation in	42	" "	10.37	" "
" " complicating disease in	20	" "	4.94	" "
" " neurotic condition in	1	" "	0.24	" "
			79.50	per cent.
" " septic infection in	55	" "	13.58	per cent.
" " no assignable cause in	25	" "	6.92	" "
			20.50	per cent.

This gives a morbidity percentage from non-septic conditions of 79.50 per cent.; from sepsis, of 13.58 per cent.; and from unknown causes, of 6.92 per cent.

Classification.—I believe this subject is best considered under three main headings: viz., (*A*) *Morbid conditions of the puerpera which antedate labor.* (*B*) *Morbid conditions which result from labor.* (*C*) *Morbid conditions which originate or first appear in the puerperium.* While it is customary to allude to many of the conditions presenting themselves under Divisions *A* and *B* as predisposing causes of puerperal morbidity, a little reflection will show that they themselves may represent morbidity of pronounced types. Conditions under division *C* are loosely spoken of as "puerperal infection," "puerperal fever," "puerperal sepsis," etc. Once regarded as manifestations of a single specific disease, they are now known to comprise a variety of local and general conditions.

CLASSIFICATION OF PUERPERAL MORBIDITY.

(A) MORBID CONDITIONS OF THE PUERPERIUM WHICH ANTEDATE LABOR.

Acute: I. Acute Toxemia of Pregnancy. II. Antepartum Sapremia or Bacteriemia. III. Chance Infection with Acute Specific Diseases. *Chronic:* IV. Chronic Toxemia of Pregnancy. V. Chronic Toxemia, etc., not Due to Pregnancy. VI. Genital and Extragenital Inflammations.

(B) MORBID CONDITIONS WHICH RESULT FROM LABOR.

General: I. Shock and Extreme Fatigue from Dystocia. II. Acute Anemia from Hemorrhage. *Local:* III. Incomplete Labor. Faulty Contraction, Evacuation, and Drainage. IV. Birth Traumatisms. V. Changes in the Locality and Activity of the Bacteria of the Genital and Perigenital Regions Induced by the Act of Labor and its Management. Migration. Inoculation. Mobilization.

(C) MORBID CONDITIONS WHICH ORIGINATE OR FIRST APPEAR IN THE PUERPERIUM.

Primary, Consecutive, and Metastatic Focal Infections.

Primary Focal Infections.

Genital: I. Puerperal Ulcers. II. Endometritis from Saprophytes. Putrid Endometritis. III. Endometritis from Pyogenic Bacteria. Simple Infectious Endometritis. IV. Endometritis from Mixed Infection. Composite Endometritis. *Extragenital:* V. Mastitis.

Consecutive Focal Infections.

Extension by Continuity. VI. Infection of Urinary Tract. VII. Proctitis. VIII. Salpingitis. Peritonitis. *Extension by Lymphatics:* IX. Metritis. X. Parametritis. XI. Peritonitis. Circumscribed or Perimetritis. General. *Extension by Veins:* XII. Metrophlebitis. Femoral Phlebitis. XIII. Specific Diseases. Gonorrhea. Diphtheria. Erysipelas. Miscellaneous.

Metastatic Focal Infections.

Blood States or General Conditions.

Simple.

I. Sapremia. II. Bacterial Toxemia. III. Bacteriemia.

Composite Sepsis.

IV. Bacteriemia with Toxemia. Septicemia. Pyemia. Septicopyemia. V. Sapremic Sepsis. (Gas Sepsis.)

Anomalies of Temperature.

VI. Hyperthermia. VII. Fever. VIII. Hypothermia.

(D) CLINICAL TYPES OF PUERPERAL MORBIDITY.

The puerpera inherits from the pregnant state any morbid condition from which she may have suffered during that period, whether called forth by pregnancy or not. While some of these conditions, especially those due directly to pregnancy, have a natural tendency to improve after delivery, others remain unaffected, and not a few tend to become worse; while conditions absolutely dormant are sometimes roused into being for the first time. The possible legacy of the puerpera must therefore always be borne well in mind. To conditions of this character must be added the shortcomings and accidents of labor itself, and the various readjustments rendered inevitable by the transition from pregnancy to the puerperium.

(A) MORBID CONDITIONS OF THE PUERPERIUM WHICH ANTEDATE LABOR.

I. Acute Toxemia of Pregnancy.—This condition is described on page 291.

II. Antepartum Sapremia or Bacteriemia.—This subject includes septic abortion (pp. 355); sapremia, etc., from dead fetus (pp. 272), and infection which begins in the course of an arrested labor, which is only an anticipation of postpartum conditions (pp. 570).

III. Chance Infection with Acute Specific Diseases.—These when severe tend ta make labor premature or incomplete and thereby favor sepsis. The cause of death in such cases is often sepsis instead of typhoid or other antecedent infectious malady. (See Diseases of Pregnancy, Part III.)

IV. Chronic or Benign Toxemia of Pregnancy.—(See Toxemia of Pregnancy, Part III.)

V. Chronic Toxemias not Due to Pregnancy.—Here belong such affections

as tuberculosis, syphilis, diabetes, uremia pure and simple, the cardiac cachexia, leukemia, exophthalmic goiter, cancer, etc., etc., all of which are considered elsewhere. (See Part III.) As a rule, they originate before conception, but sometimes do not manifest themselves until afterward, pregnancy appearing to hasten their development. In none of these conditions does delivery lead to any permanent improvement, and in many it rapidly hastens the end; so that they add somewhat to the mortality of the puerperium. Naturally sepsis is often present as a complication or is an actual cause of death.

VI. Genital and Extragenital Inflammations.—The former are described under diseases of the deciduæ (pp. 191), with special reference to gonorrheal affections. Ahlfeld has claimed that a latent gonorrheal pelvic peritonitis may be lighted up by pregnancy. Pelvic abscesses, pyosalpinx, etc., from any cause, may be ruptured during labor. *Extragenital* pyogenic processes of any sort (otorrhea, whitlow, etc.) may be the remote cause of a septic puerperium.

(B) MORBID CONDITIONS WHICH RESULT FROM LABOR.

I. Shock and Extreme Exhaustion from Dystocia naturally favor infection. Fatigue itself is regarded as due to auto-intoxication.

II. Acute Anemia from Hemorrhage.—This occurs after high degrees of postpartum hemorrhage and favors infection. The blood must lose much of its alexin or bactericidal ferment. As shock or exhaustion and acute anemia are often conjoined, it is not easy to comprehend how so many women escape infection.

III. Incomplete Labor.—This term is used to denote an incomplete third stage, although it might be extended to include retention of the fetus or ovum. An imperfect third stage may be manifested in various ways; and while due in part to natural shortcomings, may often be attributable to unskilful management. It comprises the following subdivisions: (1) *Incomplete contraction and retraction:* This condition is fully considered elsewhere (page 568). In an uncontracted uterus the venous sinuses do not close naturally and thrombi form *in situ*. Thus, hemorrhage and the development of metrophlebitis, embolism, and air embolism are favored. (2) *Incomplete evacuation:* This is considered on page 574. A variety of tissues may remain behind after incomplete expulsion of the uterine contents: viz., portions of the ovum in abortion, portions of and even the entire placenta, fragments of membranes, and blood-clots. This dead tissue forms a natural breeding-place for saprophytes. Decidual fragments and blood are hardly to be regarded as foreign bodies and escape piecemeal in the lochial discharge. (3) *Incomplete drainage: Lochiometria.* In some cases the normal anteflexion of the uterus becomes exaggerated to such an extent that there is an acute angle of flexion of the cervix and lower uterine segment which suffices to prevent the exit of the lochia. The uterus is large and soft and there are well-marked symptoms of sapremic infection. The absence of lochial discharge is of course noted. The symptoms are at once relieved by the manual replacement of the uterus. This is followed by a copious discharge of an ill-smelling fluid. As a rule, nothing is necessary, except irrigation. Much less commonly the cause of lochial retention is retroflexion of the puerperal uterus. *Lochiocolpos.* In rare instances the source of obstruction is in the vagina. This rare condition is known as "lochiocolpos." Ahlfeld reported three cases. In one the cause of retention was an intravaginal hematoma, and in another, a too thorough repair of the perineum; in the last case the patient had had a bad laceration of the perineum and her thighs had been tightly bound

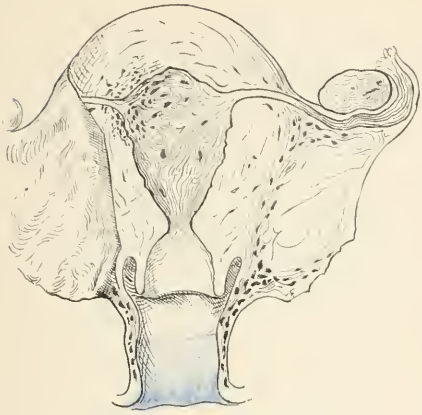


FIG. 929.—INFECTION OF THE VULVA.

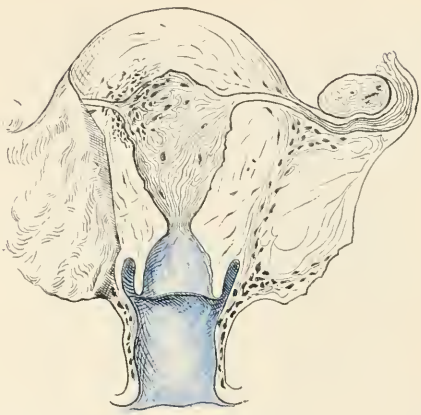


FIG. 930.—INFECTION OF THE VULVA AND VAGINA.

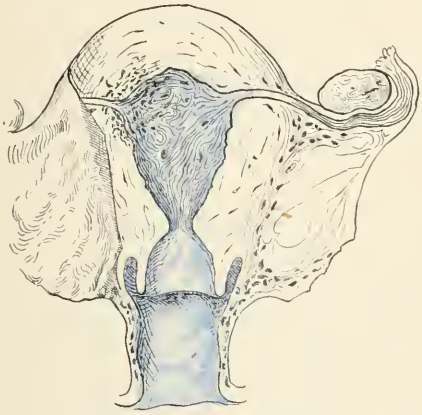


FIG. 931.—INFECTION OF THE VAGINA AND ENDOMETRIUM.

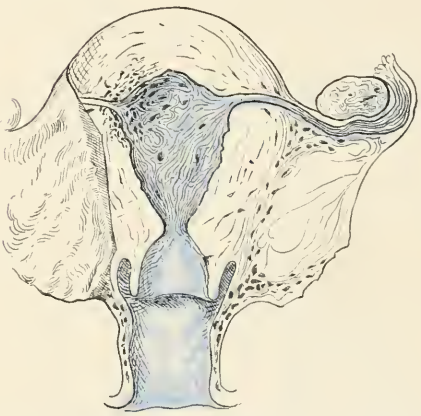


FIG. 932.—EXTENSION OF INFECTION THROUGH THE TUBES TO THE OVARY.

FIG. 933.—EXTENSION OF INFECTION THROUGH THE LYMPHATICS FROM THE UTERINE CAVITY TO THE PARAMETRIUM AND PERITONEUM.

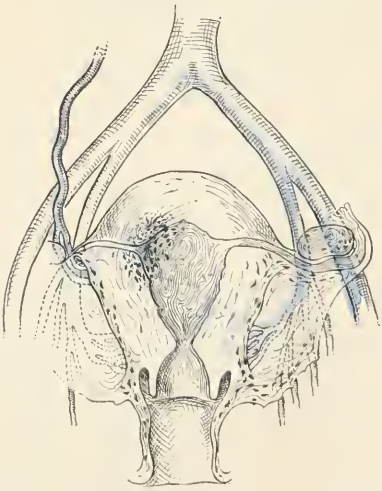


FIG. 934.—EXTENSION OF INFECTION THROUGH THE VEINS FROM THE UTERINE CAVITY IN PUERPERAL PYEMIA.

together. The treatment consists in the removal of the cause and in vaginal irrigation.

IV. Birth Traumatisms.—These have been considered under Pathological Labor (Part V). They include rupture of the uterus, lacerations of the cervix, vagina, vulva, and perineum; also certain more remote lesions, like peroneal paralysis. These injuries, especially those of the cervix, are generally recognized as among the most important factors in puerperal morbidity.

V. Changes in the Bacteria of the Genital Region.—It is conceded that in the great majority of cases the uterus and its contents are sterile before delivery. Exceptions are found in cases of endometritis and putrefaction of the dead fetus. It was formerly believed that the vagina was also sterile save in cases of gonorrhea, but the very extensive researches of Stolz,* Hofmeier, and Lenhartz have shown that a healthy vagina may harbor pathogenic germs which have evidently migrated from the vulva. The external genitals have always been recognized as swarming with germ-life. During and after delivery it has been shown that in a large number of instances the bacteria which are harbored in the vagina manage to reach the uterine cavity, where under favorable circumstances they are destroyed by the uterine secretions before they can multiply.

In regard to the nature of the germ-life concerned, the bacteriology of the vulva, vagina, and uterine cavity is practically the same; for we simply have an upward migration of the vulval germs. Hence, whatever are comprised under the latter head may be found in the upper passages. Ordinary saprophytes and pathogenic cocci may occur side by side; the saprophytes or microbes sometimes develop pathogenic qualities, while the pathogenic bacteria, so called, may play the rôle of saprophytes. Nothing appears to be gained by an extensive classification and description of these germs. The important facts to bear in mind are that the ordinary pyogenic cocci, acting temporarily as saprophytes or scavengers, may become virulent; and that the saprophytes proper, *i. e.*, the ordinary bacteria of putrefaction, may multiply prodigiously if there is any dead matter in the uterus, and set up conditions to be described later.

The bacteriology of the puerperal state is discussed more fully under the Etiology of Endometritis, page 721.

(C) MORBID CONDITIONS WHICH ORIGINATE OR FIRST APPEAR IN THE PUERPERIUM.

General Remarks.—As already stated these conditions had best be divided into *focal infections*, including both primitive and consecutive; and *blood-states* or *general conditions*, including toxæmias, bacteriemias (sepsis), pyemia, septicopyæmia; and *anomalies of temperature*, such as true fever, simple hyperthermia, hypothermia, etc. This classification is essentially pathological and must be accompanied by some of the clinical types of morbidity. Thus focal infection may or may not be associated with toxæmia or bacteriemia; of the blood-states, toxæmia often occurs without bacteriemia, but the latter is naturally associated with toxæmia, and may pursue its course with the picture of toxæmia. Pyæmia may occur by itself or associated with bacteriemia (septicopyæmia). While toxæmia and bacteriemia are usually associated with hyperthermia, simple rise of temperature may be due to nothing more than

* "Studien zur Bakteriologie des Genitalkanales in der Schwangerschaft und in Wochenbette," Wien, 1903.

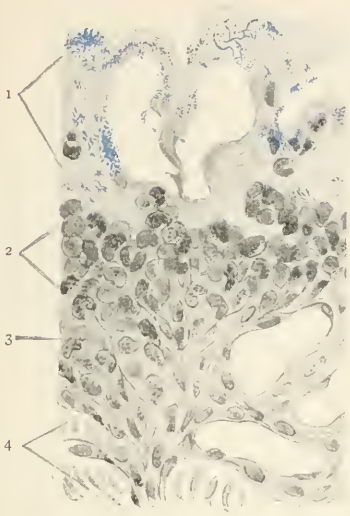


FIG. 935.—PUTRID ENDOMETRITIS IN THE PROCESS OF HEALING. 1, Necrotic surface of decidua; 2, granulation wall; 3, decidua; 4, muscle.—(*Bumm.*)

FIG. 936.—SEPTIC OR STREPTOCOCCUS ENDOMETRITIS. ENDOMETRITIS IN PROCESS OF REPAIR. 1, Necrosed decidual surface with streptococci; 2, granulation wall; 3, muscle.—(*Bumm.*)

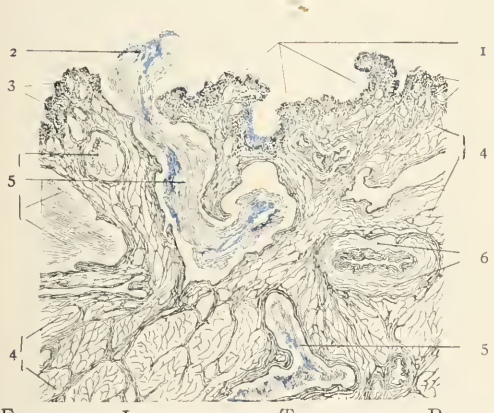


FIG. 937.—INFECTION OF THROMBI AT PLACENTAL SITE. 1, Surface of serotina; 2, septic thrombus; 3, granulation wall; 4, muscle; 5, thrombus; 6, artery.—(*Bumm.*)

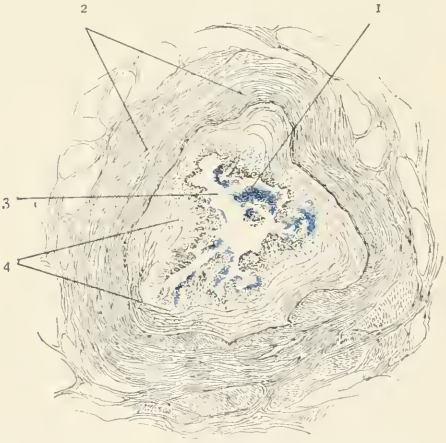


FIG. 938.—SEPTIC THROMBOPHLEBITIS OF THE UTERUS. 1, Loosened portion of thrombus; 2, vein wall; 3, vein cavity; 4, thrombus.—(*Bumm.*)

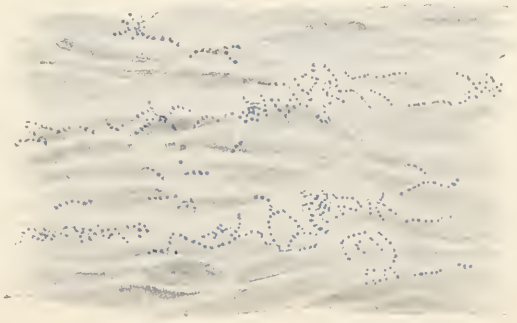


FIG. 939.—STREPTOCOCCI IN THE SMALLEST LYMPH-SPACES BETWEEN THE MUSCLE-FIBERS OF THE UTERINE WALL.—(*Bumm.*)

mental emotion or other nervous perturbation; and in the gravest types of infection the temperature may be subnormal.

PRIMARY, CONSECUTIVE, AND METASTATIC FOCAL INFECTIONS.

Focal infections may be divided into *primary* and *consecutive*. The former represent a direct inoculation of the germs into an exposed surface, while the latter include the lesions which result from extension of the primary mischief, whether by continuity of surface or contiguity. In the latter case extension occurs by the lymphatics or the blood-vessels. When bacteria are transported by the blood or lymph streams to remote regions, causing metastases, we may speak of the latter also as consecutive lesions, although they are usually treated as mere subsidiary features of a general infection of the entire organism.

Primary Focal Lesions.

Generally speaking, these result from a direct inoculation of germs into traumatic areas resulting from labor or delivery. These comprise, from above downward, the exposed placental site with its torn venous sinuses; laceration of the cervix (always present in primiparæ); and laceration of the vagina, vulva, and perineum. These lesions may vary greatly in extent, may increase in size, may coexist, or one infected area may involve another. But the primary lesions, while they may be very extensive, are not diffuse. We refer here to ordinary pyogenic cocci and saprophytes. Conditions like acute gonorrhea, erysipelas, and diphtheria, if contracted in the puerperium, are much less dependent on traumatism, and are consequently able to cause a diffuse process. But such conditions are so rare that good descriptions of them are not readily found.

Primary lesions may be discussed independently, although they are, as a rule, accompanied by complications. They may be subdivided into (1) puerperal ulcers and (2) endometritis.

I. Puerperal Ulcers.—By this term is meant the infected lacerations of the vulva, vagina, and cervix. These traumatisms have a natural tendency to repair, but if the vaginal secretions or lochia contain virulent pyogenic bacteria, healing does not occur; and if the lacerations have been closed by sutures, the latter cut through. Infection is indicated by the formation of a diphtheroid false membrane, due to the irritating properties of the bacterial toxins. Even after infection there is still a decided tendency to ultimate recovery, for the formation of a defensive wall of leucocytes and proliferation tends to prevent the penetration of the bacteria and the false membrane is exfoliated. It is important to know the clinical significance of these ulcers. In the first place, they are frequently associated with septic endometritis, in which case they represent only a minor complication. If the cervix if found free from such ulcers, there is little likelihood of an intrauterine lesion. Uncomplicated puerperal ulcers are generally spoken of as relatively harmless, but Lenhartz finds that small external ulcers may frequently cause sepsis of a severe character; the amount of toxins formed in such cases must be small, so that the sepsis produced is of the purest type.

Endometritis.—Puerperal endometritis comprises several varieties. In respect to cause, we have putrid, pyogenic, and mixed forms, according as the pathogenic microörganisms are infective, or saprophytic, or both combined. In respect to degree, we have simple, benign, or localized forms, in which the formation of the leucocyte barrier and the occlusion of the placental sinuses respec-

tively protect the contiguous structures and organism at large from the extension of the disease; the constitutional reaction being akin to simple surgical fever or simple toxemia, and malignant forms, in which the microörganisms invade the periuterine tissues by the lymphatic route or penetrate into the uterine veins, producing in many cases such formidable complications as peritonitis and pyemia.

II. Simple Putrid or Saprophytic Endometritis.—*Introduction.*—In every normal puerperium there is a slight degree of sloughing of the endometrium incidental to regeneration of that structure. Some little time is required for the formation of the regenerative leucocyte layer and the lochial secretion with its bactericidal function. During the interval which elapses between evacuation and retraction of the uterus and the establishment of these defenses, saprophytes undoubtedly enter the uterus from the vagina in a large percentage of cases and multiply to a certain extent. These comprise not only a number of species of harmless "carrion-eaters," which have never been recognized as pathogenic, and certain forms of saprophytes which are suspected of pathogenic qualities under certain conditions, but also highly virulent germs which are capable of behaving as saprophytes in particular cases, including the streptococcus pyogenes. We do not know whether these saprophytes should be regarded as physiological scavengers or as meddlesome intruders. Since the discovery of the existence and properties of intracellular ferments, we recognize the fact that bacteria are not essential to the breaking up of cast-off protein matter. After the establishment of the lochial discharge, the tendency of the uterus is to purify itself of germ-life. Bearing in mind this fact, in association with the treacherous character of bacteria, it is probably best to regard all germ-life in the puerperal uterus as something foreign and undesirable; but whether accomplished by tissue-ferments, saprophytes or both conjoined, there is no doubt that the refuse proteid matter of the regenerating endometrium, in breaking up into simpler and more soluble and diffusible cleavage-products, is able to cause a very mild and transitory autointoxication, recognizable by the thermometer in a half—perhaps even more—of all puerpera. This condition, commonly known as "one-day fever," is described under clinical types. Endometritis as such does not coexist—aside from the normal regenerative changes in the endometrium which hardly merit such a

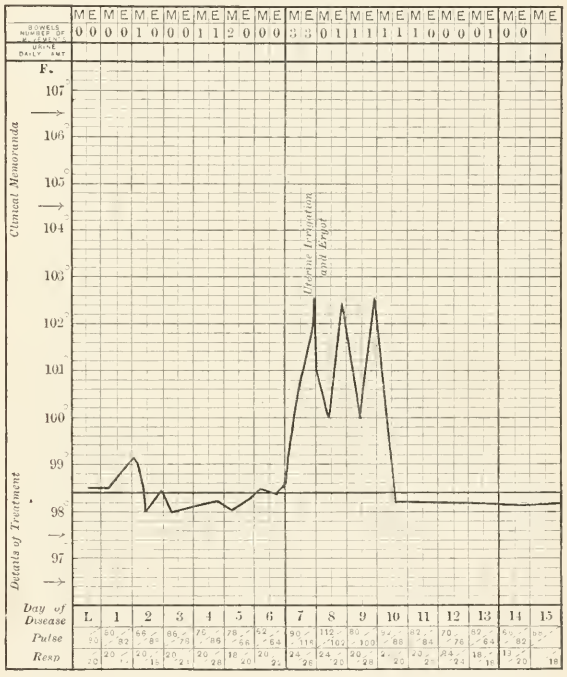


FIG. 940.—FEVER DUE TO SAPREMIA (SEPTIC INTOXICATION) ON THE SEVENTH DAY OF THE PUERPERIUM, RELIEVED BY ONE UTERINE IRRIGATION, FOLLOWED BY THE USE OF ERGOT.

name. Bumm, who believes that in a normal puerperium the uterine cavity is sterile from first to last, asserts that the normal lochia are always sterile until they reach the vagina, when they quickly putrefy. Such a condition of affairs may frequently occur, but is not the rule.

Since saprophytes multiply in proportion to the amount of dead material present in the uterus, it is evident that the local and general reaction must depend largely upon the latter factor. Even if these germs are essentially foreign to the uterine cavity, the presence of a certain amount of putrefaction of residual shreds of decidua, blood coagula, etc., during the establishment of the lochia is not necessarily a pathological process, and is not regarded as constituting an indication for intervention. This condition, which may be termed simple putrescence of the lochia, will be alluded to again under **clinical types.** The process is not sufficiently active to produce endometritis or toxemia, or to interfere with normal regeneration. It is otherwise when there is considerable retained matter, either from imperfect evacuation of the placenta or membranes, or defective drainage (lochiometra). A double danger is present when the uterus is not completely emptied, for normal contraction and retraction cannot occur. The placental sinuses, instead of closing by adhesion of their walls, become plugged by thrombi, and the process of normal regeneration with formation of a bactericidal lochia, is somewhat disturbed. In retention of the entire placenta, of the entire ovum or fetus, in gangrene of the uterus from pressure—in general wherever there is an opportunity for extensive putrefaction, one of two things must happen if the uterus is not promptly evacuated: viz., putrid endometritis with high degrees of sapremia develops as an uncomplicated condition, or from virulent and infectious germs already present in the uterus or conveyed there by attempts at evacuating the uterus becoming roused to activity, a mixed endometritis, to be considered later, is set up.

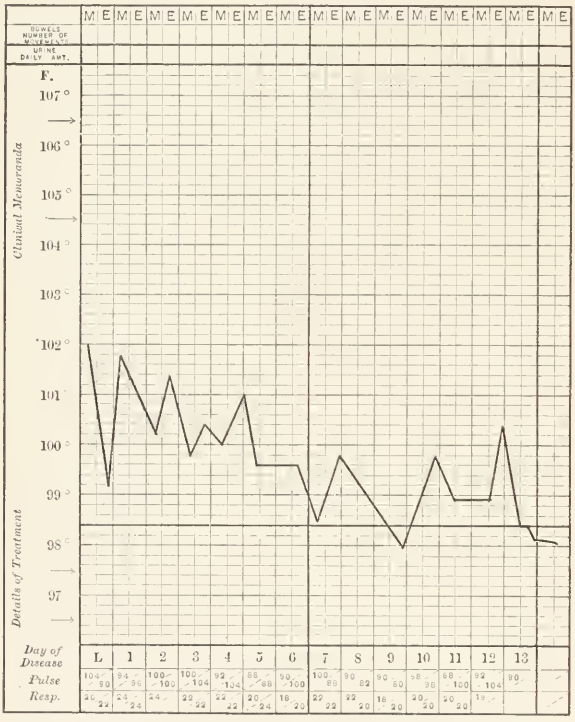


FIG. 941.—FEVER DUE TO MILD INTRA-PARTUM INFECTION FOLLOWING VERSION ON A MACERATED FETUS. MATERNAL SYPHILIS.

Definition.—Putrid or saprophytic endometritis is an endometritis set up by the contact of the irritating secretions of the saprophytic bacteria together with some of the products of the putrefaction of the dead proteid matter retained within the uterus; in other words, the irritant material is composed of bacterial toxalbumoses and ptomaines. It is never, perhaps, a purely local affair, being accompanied by the results of absorption of the irritant material

by the lymphatics and veins, expressed clinically by the phenomena of sapremia (*q. v.*) (p. 741).

Pathology and Pathogeny.—The irritant substances in question set up an endometritis which has a more or less constant tendency to end in necrosis of varying degrees. If the uterus is evacuated within a reasonable interval, necrosis of the endometrium does not result; but if the condition is left to itself, the saprophytes accumulate in such numbers and activity that the endometrium, already in the act of throwing off dead material, becomes involved in the necrosis. If the degree of the latter is slight, we have only an intensification of the normal exfoliation of the mucosa; and, with cause removed, the formation of the leucocyte layer and the bactericidal lochia, albeit somewhat delayed, prevails in the end over the pathogenic factors. If the circumstances are less favorable, the degree of necrosis may be sufficient to interfere utterly with normal regeneration and purification of the endometrium. Mixed infection then develops, or in certain cases the putrid endometritis may acquire such severity that the patient may die of intense sapremia, or even in rare cases of a generalization of the saprophytes throughout the system (gas-sepsis). The latter termination must be of very rare occurrence, and its existence is difficult to demonstrate. In the majority of such cases mixed infection is present; or the saprophytes do not become generalized until the patient is dead or at least moribund. (Figs. 935 and 936.)

Symptoms.—In putrid endometritis, the uterus is not properly contracted, and more or less tenderness is present. The lochia are very fetid, and contain much necrotic debris and are frothy from admixture of gas-bubbles. Pus is not present. An examination of the secretions shows the presence of saprophytes. The lochia may be "suppressed"; this is not due to a drying up of the secreting surface, but to some form of mechanical obstruction—either anteflexion of the uterus or plugging of the os with necrotic tissue. When the obstruction is removed, there is a profuse escape of pent-up lochia having the characters already described. Putrid endometritis is always accompanied by sapremia which varies in degree with the amount of putrefaction. Pure sapremia, which is always due to this condition, is discussed separately on page 741.

Diagnosis.—The various diagnostic points are included in the preceding paragraph. An absolute diagnosis must rest upon the bacteriology.

Prognosis.—As long as the condition is simply a putrid endometritis, the prognosis depends largely upon the promptness and completeness with which the uterus is evacuated. But even after existing for a number of days, emptying of the uterus may be followed by recovery. Much also depends upon the rapidity of absorption of the toxins. The sapremia may be so acute that the patient's vital organs are quickly overwhelmed. On the other hand, the steady and protracted absorption of toxins in an unrelieved case naturally tends to cause death by exhaustion.

Treatment.—See page 726.

III. Simple Pyogenic or Infectious Endometritis.—*Definition.*—A puerperal focal lesion due to the pathogenic action of infectious microörganisms upon the endometrium which is in course of regeneration.

Etiology and Pathogeny.—The various predisposing and exciting causes of pyogenic endometritis have been outlined in the general sections on the morbidity of the puerperium. We do not find here the unevacuated or undrained uterus which is a necessary factor in the production of the putrid and mixed forms of endometritis. Other factors come into play, such as the ascent into the uterus, during or after delivery, of infectious germs which have in some

manner found their way into the vagina; or the direct inoculation of the uterine cavity by the surgeon's instruments or hands in connection with the artificial termination of labor. Epidemic prevalence of the disease is a prominent factor. In certain cases the endometrium is infected from birth wounds of the lower genitals. It is often impossible to determine how infection takes place, so that we are forced to think of a preëxisting endometritis or a hematogenous infection. Finally, predisposition plays an important part. Whatever greatly lowers the resisting powers of the puerpera during the early days of the puerperium, before the establishment of the natural defenses—especially hemorrhages, eclampsia, preëxistent toxic states, the shock of protracted labor, etc., etc., all render it possible for pyogenic cocci, which ordinarily would enter the uterus as saprophytes, to become pathogenic. In many of these cases the uterus, which has been completely evacuated, is nevertheless unable to contract properly. The placental sinuses remain patulous, or are imperfectly closed by thrombi; and it is this locality which is usually first attacked by the pyogenic cocci, many cases of simple infectious endometritis remaining localized in this area. (Figs. 937 and 938.)

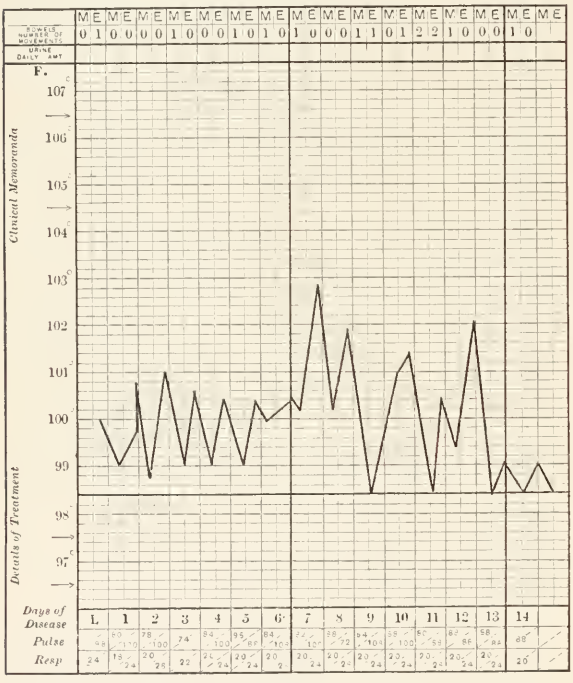


FIG. 942.—FEVER DUE TO MILD STREPTOCOCCUS INFECTION.

The bacteria which cause this form of endometritis consist of the common pyogenic microörganisms, chiefly the streptococcus pyogenes, but occasionally the staphylococcus aureus and albus, and more rarely of other pyogenic bacteria. A mixture of infection is not uncommon.

The pathogeny of infectious endometritis differs notably from that of the putrid form. In the latter, as already stated, the bacteria do not attack the living tissues, and the inflammation is produced entirely by the corrosive action of the bacterial secretions and decomposition products of the dead tissue. In pyogenic endometritis, on the other hand, the bacteria attack the living tissues, and through multiplying therein, produce a necrotic layer which greatly resembles the false membrane of true diphtheria, and which may vary greatly in thickness and extent. In its lightest form it has been compared to a mere "haziness," while in the higher degrees the necrotic endometrium may come away in large shreds. When dead tissue thus appears in the uterus to this extent, certain complications may arise. Thus the os may be obstructed temporarily, and the lochia pent up. Again the presence of the dead tissue favors the development of an associated putrid endometritis.

Symptoms; Course.—If the endometrium is attacked by pyogenic cocci during

the period of regeneration, a struggle for the mastery ensues between the micro-organisms and the defensive forces. If the latter prevail, the leucocyte barrier increases in extent, pus is formed in increasing amounts, and through the mechanical action of this fluid, the necrotic tissue is broken up and washed away. The lochia acquires bactericidal properties, and the uterine cavity tends to become sterile. Under these circumstances the disease runs a benign course. The uterus exhibits some tenderness, and an ordinary surgical fever is present, caused by absorption of the toxins secreted by the bacteria. The lochia are purulent and entirely devoid of odor and the microscope reveals the presence of one or more forms of pyogenic cocci.

If, on the other hand, the disease-germs prevail over the vital forces, *malignant endometritis* results. Two very different types of the latter are recognized and the two may be combined to form a third. Since infection usually begins at the placental site, much depends upon the condition of the latter at the time. If the uterus is well retracted and the sinuses closed, the defense at this point is effective. If the sinuses are simply plugged with aseptic thrombi, virulent germs may infect the latter directly, or may first penetrate between the sinuses, and eventually through the walls of the latter from without. This type of malignant endometritis which passes directly into pyemia, is manifested usually by a succession of chills denoting the sudden entrance into the circulation of a large amount of toxic material. In the other type of malignancy we may suppose that the placental sinuses escape, but that the endometrium is the seat of extensive pyogenic infection; the virulence or numbers of the germs enable them to penetrate the leucocyte barrier and enter the subjacent lymph-spaces in such numbers and activity as to infect the parametrium or perimetrium or even the blood itself. Clinically this type of endometritis would be expressed by evidences of pelvic inflammation superadded to uterine pain and tenderness. As is readily apparent from what has been said, the moment an endometritis is to be classed as malignant, the infection has already extended beyond the uterus—either along the uterine veins or into the pelvis. These two types of malignant endometritis, viz., the venous and lymphatic, may be conjoined, and we then have a special blood-state termed septicopyemia (*q. v.*).

Diagnosis.—In the milder forms of pyogenic endometritis there may be but little constitutional disturbance—nothing beyond a slight resorption-fever—and local symptoms may likewise be absent. Under such circumstances diagnosis can be made only by the purulence of the lochia, and the presence therein of the pyogenic cocci in large quantities. In higher degrees we find tenderness and the toxemic state more highly developed, this accentuation, as in other suppurating cavities, being sometimes dependent upon imperfect drainage. The evidences of malignancy have already been enumerated. Since streptococci have been known to enter the circulation and remain therein in a latent state for days, we should examine the blood in all cases of persistent elevation of temperature, even in the absence of symptoms of blood infection, or extension of the morbid process beyond the uterus.

Prognosis.—As long as the uterus is movable, drainage maintained, blood examinations negative, and the march of the temperature in accord with simple localized suppuration, the prognosis is good, the condition hardly calling for active treatment. As soon as there is evidence of extension of the process by the veins or lymphatics, the question is no longer one of endometritis, for the latter, *per se*, could hardly endanger life. In those extreme cases in which the entire uterus is inflamed and softened, extension of the disease has already occurred, death really taking place from pyemia or peritonitis.

Treatment.—See page 726.

IV. Endometritis from Mixed Infection; Composite Endometritis.—While this affection is of frequent occurrence and is naturally grave in character, its characteristics have been so thoroughly discussed under the individual types of endometritis that but little more need be given here than a recapitulation.

FIG. 943.—PUERPERAL UTERUS, THREE HOURS POST PARTUM, THE SITE OF STREPTOCOCCUS ENDOMETRITIS.—(*Sellheim.*)

Whenever an unevacuated uterus leads to the development of putrid endometritis, a pyogenic infection is readily grafted upon the initial trouble. If streptococci are present at the outset, as "acting saprophytes," they may be roused

FIG. 944.—SAGITTAL SECTION OF A PUERPERAL UTERUS THREE HOURS POST PARTUM WITH STREPTOCOCCUS ENDOMETRITIS. Same case as Fig. 943.—(*Sellheim.*)

to the virulent or infectious state through rapid multiplication in the presence of the necrotic tissue. From another point of view the presence of a putrid endometritis causes a lowering of the local resisting power, an impairment of

the regenerative faculty of the endometrium, and a depreciation of the bactericidal power of the lochia. Under these circumstances streptococci, however introduced into the uterus, are able to flourish and exert their pernicious influence.

We have already seen that putrid endometritis need not always be the primary lesion; for the diphtheroid membrane which results from pyogenic infection of the endometrium constitutes necrotic tissue upon which saprophytes are able to feed and increase in numbers. According to Bumm, the pyogenic cocci usually take precedence in associate infection; they cause necrosis of the

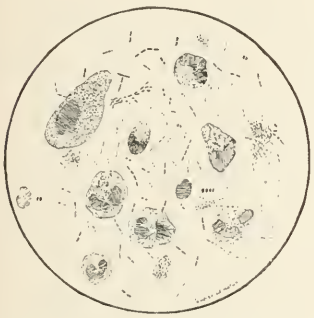


FIG. 945.—LOCHIAL SECRETION OF PUTRID ENDOMETRITIS.—(*Bumm.*)

FIG. 946.—LOCHIAL SECRETION OF SEPTIC ENDOMETRITIS.—(*Bumm.*)

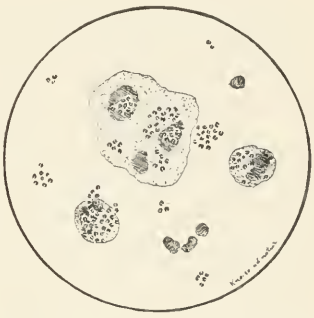


FIG. 947.—LOCHIAL SECRETION OF GONORRHEAL ENDOMETRITIS.—(*Bumm.*)

endometrium, and thereby enable the saprophytes to obtain a foothold. Generally speaking, the conditions are such that the development of mixed endometritis is naturally favored. Pure examples of saprophytic or pyogenic infection are doubtless less frequent than is usually taught.

Symptoms; Course.—In the majority of cases composite endometritis doubtless begins with the putrid form; *i. e.*, with an unevacuated uterus. If the latter is emptied, the expected defervescence does not occur, and it becomes apparent that the composite endometritis has been transformed into the simple pyogenic form. The prognosis of the latter is, however, much graver than is

FIG. 948.—GLASS CANNULA FOR OBTAINING LOCHIAL SECRETION FROM THE UTERUS. (½ natural size.)

the case when the pyogenic affection is primary; and it is very evident that the associate affection has so crippled the defenses of the organism that the endometritis is very likely to become malignant.

As already implied, unless the putrid endometritis is of such intensity or duration as to necrotize the endometrium, thorough evacuation of the uterus will transform the composite into the simple pyogenic form—since the saprophytes are thereby deprived of nutriment. Under unusual circumstances, such as retention of a large amount of fetal tissue for a protracted period, or pressure-gangrene of the uterus, the putrefaction of the latter is so extensive that removal

or disinfection of the necrotic tissue is impossible. If after repeated douching of the uterus the lochia continue fetid, it is evidence that the endometrium has been extensively involved in the putrefactive process. Such cases naturally remain composite to the end, and are comparable with neglected cases in which, for one reason or another, there has been no attempt to evacuate the uterus.

When under such circumstances the affection remains composite to the end, the condition known as sapremic sepsis develops; or, in other words, the blood changes which tend to accompany each disease singly, are found side by side.

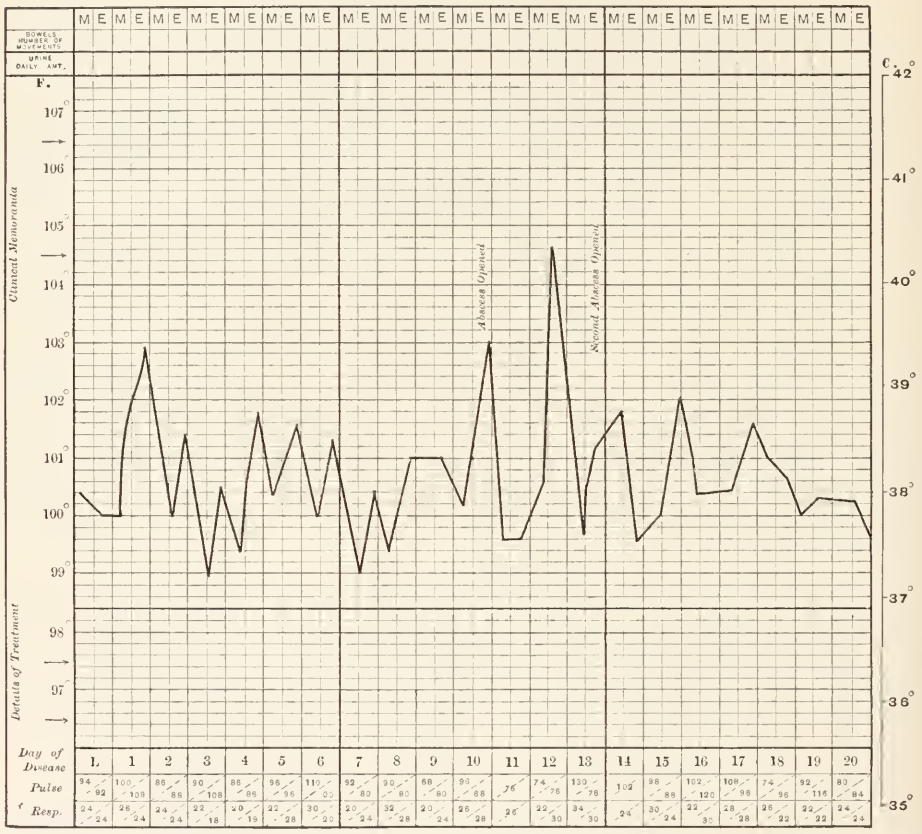


FIG. 949.—FEVER DUE TO SUPPURATIVE MASTITIS. Two abscesses in one breast incised and drained. Temperature on the twenty-seventh day of the puerperium normal and pulse seventy-four.

Moreover, in the very highest type of puerperal morbidity, the saprophytes may enter the circulation before death and cause the so-called gas-sepsis (*q. v.*). Uncomplicated sapremia (from putrid endometritis) and uncomplicated sepsis are without doubt responsible for many deaths among puerperæ; yet it is very likely that in untreated cases mixture of infection results sooner or later.

Diagnosis.—The lochia afford the sole means for a rational diagnosis. If this discharge is both fetid and purulent, containing in addition gas-bubbles; and if a microscopic examination reveals both saprophytes and pyogenic cocci in large numbers, the diagnosis is assured.

Prognosis.—If defervescence occurs within a reasonable period after the uterus has been emptied and irrigated, the prognosis is good. If the fever does not disappear, or if it returns after a short fever-free interval, it is probable that the streptococci have passed beyond the confines of the endometrium.

V. Mastitis.—(See Diseases of the Breast, Part VII.)

Primary focal lesions in the genital canal which result from specific infectious processes, as gonorrhea, diphtheria, and erysipelas, receive separate attention on page 737.

I have already insisted that malignant puerperal endometritis implies some form of secondary extension of the primary mischief; in other words, it is not merely the going from bad to worse of the uterine lesion. I shall first enumerate the results of extension by continuity of surface, which are relatively benign in comparison with the conditions which result from extension along the vessels. From puerperal ulceration near the urethra, the *urinary tract* may become involved; from ulceration of a complete perineal tear, the *rectum* may be involved, at least in theory. Finally, in pyogenic endometritis the *tubes* are readily involved by continuity. These conditions are now briefly described.

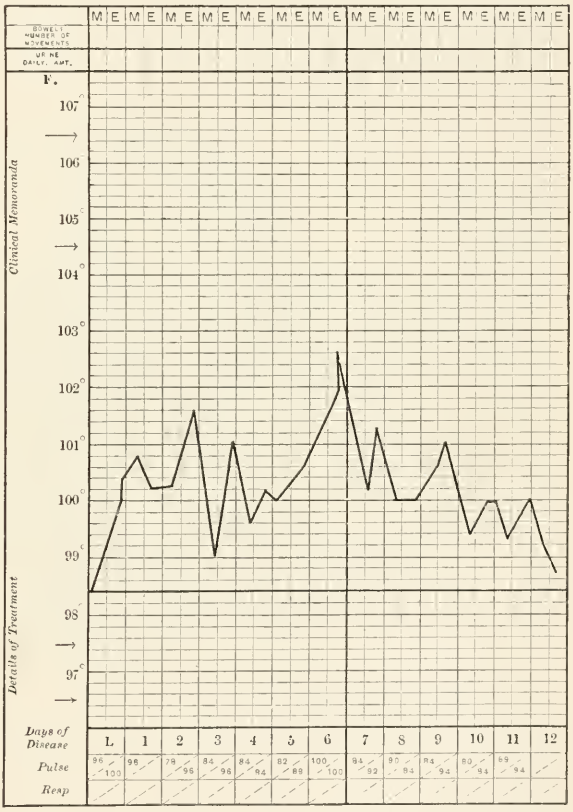


Fig. 950.—Fever due to Gonorrheal Cystitis in the Puerperium, the Gonococcus being found in the Pus from the Urethra. Irrigation of the bladder practised and urotropin administered.

Consecutive Focal Infection.

Consecutive Lesions from Extension by Continuity.

VI. Puerperal Infection of the Urinary Tract (*Pyogenic Urethritis, Cystitis, Pyelitis, Pyelonephritis*). — Naturally these conditions do not differ materially from ordinary urinary infection from the use of septic catheters. Indeed, this very accident may occur in the puerperium, and hence catheterization is to be avoided as far as possible and done only under the strictest asepsis (see Management of Puerperium).

VII. Puerperal Proctitis.—This condition, which is extremely rare, and might also occur from some accident, as from a septic syringe, represents an inoculation of some raw surface, and is in fact a puerperal ulcer of the rectum, having the same symptoms, diagnosis, and treatment. Puerperal rectal gonorrhea may occur.

VIII. Puerperal Salpingitis.—This is stated to be a somewhat infrequent consecutive lesion and must be distinguished from salpingitis which occurs secondarily to peritonitis. Uncomplicated salpingitis from direct extension of pyogenic endometritis has the characters of abscess-formation, supervening with a rigor, a fever which may reach 104°, and in some cases severe pain. Physical examination will reveal a tumor which when developed is of a sausage shape.

Consecutive Lesions Due to Extension Along the Uterine Vessels.

We know that even in relatively mild cases of endometritis, streptococci are able to break through the leucocyte barrier into the uterine lymph spaces, although they do not necessarily set up metritis or other consecutive lesions. Generally speaking, whenever the pyogenic cocci pass this barrier, we should no longer speak of endometritis, for with these germs once in the lymph spaces there is nothing to prevent the further extension of infection which may involve the uterus, parametrium, perimetrium, or ovary; in fact all the accidents of extension result here save those which arise from direct extension along the veins at the placental site. We therefore differentiate between lymphatic and venous septicemia, the latter being known as pyemia.

Consecutive Lesions from Lymphatic Extension.

These comprise metritis, pelvic lymphangitis, parametritis, oöphoritis, perimetritis (or benign peritonitis), and malignant or general peritonitis. The participation of the peritoneum may be secondary to metritis or parametritis. With any of the accidents we see always the occurrence of toxemia with or without bacteriemia. It should be stated, also, that a low form of peritonitis may follow simple putrid endometritis and also gonorrhea. On the other hand, sepsis may be so sudden and intense in development that dissolution of the blood may outstrip the formation of consecutive foci. Under such circumstances there would probably be found at autopsy some such coincidence as antepartum sepsis, with pressure-gangrene of some part of the uterus and evidences of beginning peritonitis. From the blood and some of the viscera we may obtain pyogenic cocci in association with putrefactive bacteria.

The consecutive lesions enumerated above will now be discussed individually

IX. Metritis.—This term is practically synonymous with *malignant endometritis*. As the endometrium and muscularis are continuous the latter is invariably infected whenever the leucocyte barrier does not withstand the attacks of the infecting organisms. The streptococci usually multiply along the coarser lymphatics of the uterus, and may not pass through the vascular walls. In this case the parametrium may be the first structure to feel the brunt of the attack or the peritoneum may be selected. In other cases the streptococci multiply throughout the finer lymphatics as well, and also pass through the vascular walls, setting up intramuscular abscesses, and sometimes lead to necrosis of entire portions of the musculature (metritis dissecans). This so-called lymphatic infection of the uterus is probably less common than the direct infection of the veins at the placental site. The latter is the first and commonest seat of puerperal endometritis, and Lenhartz states that at least one-half of all puerpera who come to the autopsy-table show some evidence of thrombophlebitis. The streptococci may not only enter the lumen of the veins, but may also proceed along their outer walls and eventually penetrate them. As soon as the thrombi once become infected, it is no longer a question of metritis, for the disease is

propagated along one or more of the uterine veins, and we have special consecutive lesions.

Consecutive lesions beyond the limits of the uterus must now be considered. As already stated, these are divisible into (1) lesions due to lymphatic extension—parametritis, ovaritis, perimetritis (or benign peritonitis), and general or malignant peritonitis—and (2) lesions due to venous extension, which comprise the various types of puerperal phlebitis.

X. Parametritis.—This lesion is caused by propagation of the streptococci from the lymph spaces of the muscularis of an infected uterus and also from extensive cervical puerperal ulcers which extend directly into the parametrium. In the former case the germs are propagated along the pelvic lymphatics where they set up a lymphangitis; while in the latter case cellulitis is the immediate result. In the absence of natural barriers the loose tissue of the pelvis is quickly

FIG. 951.—UTERUS AND ADNEXA FROM A CASE OF ACUTE STREPTOCOCCUS INFECTION AND SEPTICÆMIA LYMPHATICA. Death on twelfth day after Cæsarean section. No peritonitis and no pus in the tubes; macroscopic appearance of endometrium normal.—(*Author's case at the New York Maternity.**)

infected. The parametrium of one or both sides becomes the seat of hyperemia and serous infiltration. The diseased foci, usually miliary, are then invested by a wall of leucocytes which limits the further extension of the process. Abscess-formation occurs whenever the miliary foci coalesce, but the natural leucocyte defense is generally so vigorous that the streptococci are vanquished at an early stage before coalescence occurs. In this termination the exudation is gradually absorbed. When abscess-formation occurs the pus tends to gravitate into the perirectal and retroperitoneal connective tissue. The abscess may penetrate into the rectum or vagina or may point externally at the groin above Poupart's ligament. (Figs. 954 and 955.)

Parametritis may, of course, be but a single feature in a complicated septic process, in association with endometritis and other local lesions and septicemia;

* See "Trans. N. Y. Obstetrical Society," April 16, 1895.

but when parametritis is the principal lesion, it simply gives rise to the same constitutional reaction as does any other large acute abscess, and it would hardly be proper to rank such a condition as puerperal sepsis. Thus, invasion of the parametrium is heralded by a chill and a sharp rise of temperature, and a typical suppuration-fever follows. If the leucocyte defense succeeds in keeping the minute initial abscesses from coalescing, the process is aborted in about ten days or two weeks and defervescence results; but if the streptococcus prevails, the gradual formation of the abscess is marked by the usual temperature curve of an abscess fever. High evening temperatures are succeeded by profuse sweats and morning remissions. Relief by natural or surgical evacuation is followed by defervescence. Clinically the rigor and rise of temperature are associated with pain and tenderness *in situ* and in some cases pressure-pain is also referred to the lower extremities or loins. Bimanual examination reveals the presence of a mass at one side of the uterus (exceptionally at both sides); several days, however, being required for the development of the exudate. The mass at the side of the uterus tends to increase in size, and the sensitiveness

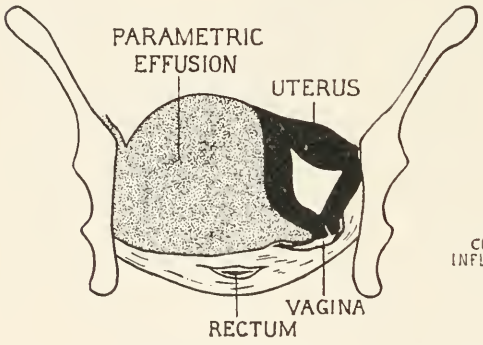


FIG. 952.—PARAMETRIC INFLAMMATION IN THE CELLULAR TISSUE OF THE RIGHT BROAD LIGAMENT PUSHING THE UTERUS TO THE LEFT.—(*Dakin.*)

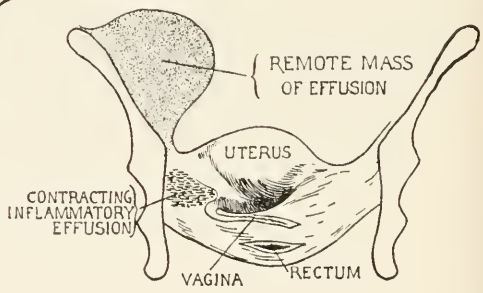


FIG. 953.—PARAMETRIC INFLAMMATION OF THE CELLULAR TISSUE OF THE RIGHT ILIAC FOSSA, AND SLIGHT INDURATION IN THE RIGHT BROAD LIGAMENT. THE UTERUS IS IN THE NORMAL POSITION.—(*Dakin.*)

to manipulation increases, especially in cases in which the peritoneum becomes involved secondarily. The respective terminations in resolution and suppuration have already been noted. In either case more or less of the infiltration may persist as organized connective tissue, and incidentally the uterus may become displaced in any one of several fashions.

The diagnosis of parametritis is naturally considered with that of perimetritis, for the two conditions not only present much in common, but very often coexist.

XI. Peritonitis.—*Benign Forms Of.*—Under this head belong various types of circumscribed peritonitis which comprise perimetritis, perisalpingitis, perioöphoritis, etc., and which are due to a simple extension of inflammation from the uterus, parametrium, tubes, ovaries, etc. The peritoneum may also be involved as a result of rupture of the uterus, of a parametritic abscess, and of emigration of bacteria (practically only the gonococcus) from the tube into the peritoneal cavity. Unless the bacteria which come in contact with the peritoneum possess a high degree of virulence, the inflammation remains circumscribed, chiefly because the exudation brings about adhesion of the parietal and visceral peritoneum with resulting encapsulation of germs. The systemic reac-

tion in these cases is that of localized peritonitis rather than what is comprised under puerperal infection. In regard to the genesis of peritonitis in the puerperium, the lymphatics are in most cases the organs at fault; the bacteria passing from the lymph spaces of the uterus directly into the peritoneal cavity. Thus perimetritis becomes much the more common localization. The other local types already mentioned occur with greater infrequency, by reason of their special etiology. It may be stated that a severe parametritis almost necessarily extends to the peritoneum, and that the same is true of acute salpingitis, acute oöphoritis, etc. When peritonitis results from rupture of the uterus, or from an acute abscess, etc., its character must depend wholly upon the relative virulence or sterility of the escaping substances, and the same is true of the escape of

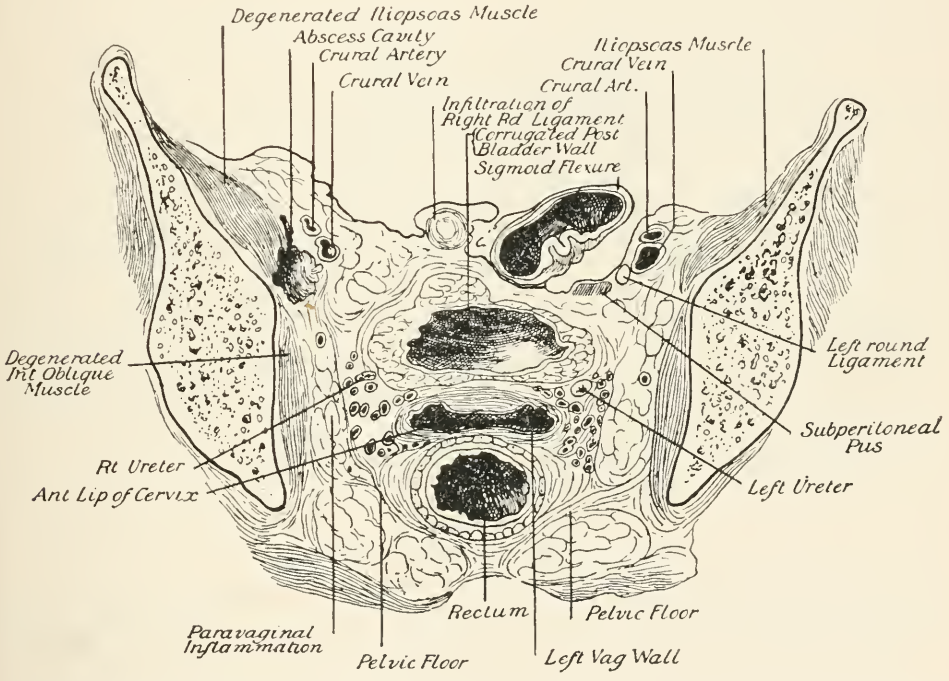


FIG. 954.—TRANSVERSE SECTION OF THE PELVIS FROM A PRIMIPARA FOUR AND A HALF MONTHS POST PARTUM, SHOWING PARAMETRITIS AND THE FORMATION OF PUERPERAL PELVIC ABSCESSES.—(*Sellheim.*)

pus from the tubes into the peritoneal cavity. In all such cases the perimetrium is necessarily attacked. Hence for practical purposes benign peritonitis is virtually equivalent to perimetritis. (Fig. 956.)

Perimetritis.—This condition, like endometritis and parametritis, possesses a distinct clinical individuality, and occurring as the chief clinical feature of a morbid puerperium may run its course as a local infection with its natural systemic reaction. The most important thing to know about perimetritis is that it occurs chiefly from propagation of bacteria through the lymph spaces of the muscularis of the uterus, without the necessary production of a high degree of metritis. When the streptococci enter these lymph spaces, it is only when of the highest virulence that they occupy the finer radicles and from these

attack the muscular substance. Under ordinary circumstances they simply travel along the coarse spaces until the peritoneum is reached; so that perimetritis is much more likely to result than severe metritis. Through this peculiarity we are able to understand why bacteria of low virulence, such as the gonococcus and even saprophytes (as Ahlfeld implies), may in some cases reach the peritoneum and set up a low grade of perimetritis. Ahlfeld believes that the puerperium often rouses to activity a preëxistent slight localized perimetritis, especially in latent gonorrhea.

The course of benign peritonitis has already been stated. The exudate which is shut off by adhesions may be either serofibrinous or purulent. Of great interest is the frequent occurrence in pus of this source of the bacillus coli, which is believed to pass through the intestinal wall after adhesions have formed.

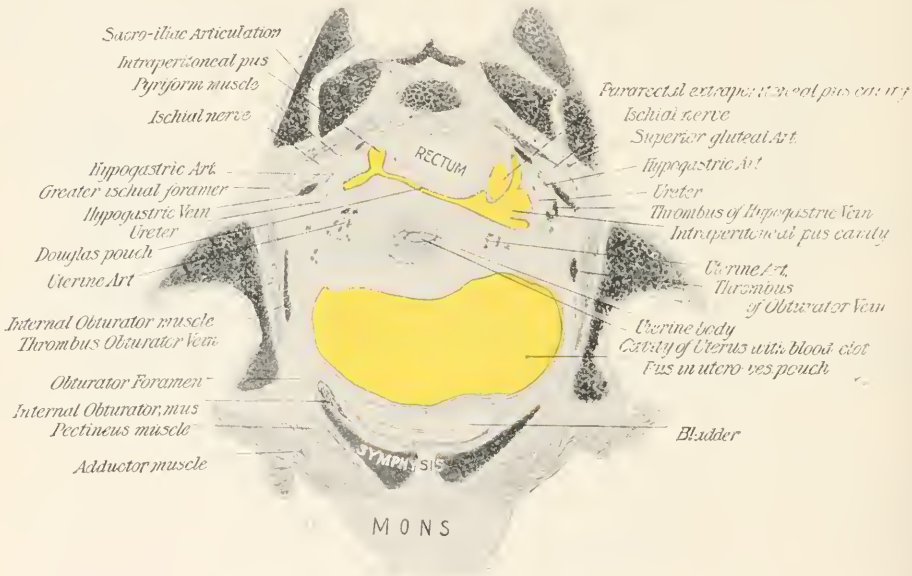


FIG. 955.—HORIZONTAL SECTION OF A PELVIS FROM A PRIMIPARA THREE WEEKS POST PARTUM, SHOWING ABSCESS CAVITIES IN UTERO-VESICAL POUCH, IN DOUGLAS'S CUL-DE-SAC, AND ALSO PARARECTAL AND EXTRAPERITONEAL SUPPURATION.—(*Sellheim.*)

When pus forms in connection with perimetritis, the almost invariable result is intestinal perforation.

While perimetritis may occur as part of a general septic process, or in association with parametritis, it may also in certain cases constitute the principal feature of the puerperal morbidity, especially in the cases described by Ahlfeld in which an old perimetritis is roused to activity by labor. Under such circumstances we should expect to see the symptoms of an ordinary peritoneal reaction, including great pain and tenderness, small, rapid, and incompressible pulse, rapid breathing, thirst, and vomiting. The patient lies in the dorsal position with knees drawn up to diminish abdominal tension. Perimetritis is ushered in by a chill and a sharp rise of temperature, which continues moderately high and without morning remissions while somewhat higher at night. When pus forms, a second chill and renewed ascent of temperature occur. After perimetritis has lasted for several days the presence of the exudate may be made out in

Douglas' *cul-de-sac*, or in some cases in the entire lesser pelvis. This having become encapsulated, the uterus is immobilized. If suppuration does not occur, this exudate may be absorbed after several weeks; but with the formation of pus, softening and fluctuation become apparent, and the abscess, as already stated, may be expected to rupture into the intestine, or exceptionally into the vagina, or externally, or even through the limiting wall into the general peritoneal cavity. The *diagnosis* of perimetritis should not be difficult, since the phenomena of the peritoneal reaction are so characteristic. The chief point of interest lies in distinguishing at the outset between perimetritis and parametritis; since both affections begin at about the third or fourth puerperal day with a chill and sharp rise of temperature, and are attended with pain, tenderness, and the formation of plastic material. The peritoneal reaction should be sufficient for discrimination. It frequently happens that the two affections coexist, and in this case the symptoms of parametritis are naturally masked, and a bimanual examination becomes indicated, which, owing to the great pain and tenderness resulting, can with difficulty be carried out.

General or Malignant Peritonitis.—Bacteria of comparatively low virulence bring about benign peritonitis or perimetritis; and under precisely the same circumstances, highly virulent germs cause a general peritonitis. According to the general teaching the latter affection follows most commonly upon an endometritis set up by highly infectious germs; Lenhartz, however, has shown the great relative frequency with which severe parametritis can bring about malignant peritonitis. But this affection is not due necessarily to lymphatic extension, since it may result from direct inoculation of the peritoneum by the contents of a ruptured uterus or a preëxisting abscess. It has been commonly taught that malignant peritonitis is usually a complication or feature of severe general sepsis, both being the natural consequence of highly virulent streptococci; but many case-histories seem to show that the general condition in malignant peritonitis is not septic infection of the blood, but profound toxemia caused by the rapid multiplication of germs over the entire peritoneal surface. In other words, malignant peritonitis may often represent a purely local infection, limited only by the great extent of the peritoneum.

Malignant peritonitis is undoubtedly due to the high virulence of bacteria which spread over the peritoneal surface without any attempt at the formation of isolating adhesions. It does not appear that the germs are necessarily of unusual virulence before gaining the peritoneum, but may find conditions there which favor their rapid multiplication.

Case-histories show that a woman may be fatally septic and yet have only a localized peritonitis; while as already stated, complete purulent peritonitis may not be accompanied by general sepsis. (Fig. 956.) There is much evidence to show that lymphogenic malignant peritonitis is a phase of puerperal morbidity which is *sui generis*, bearing no definite relationship to perimetritis, endometritis, or septic infection of the blood. It is preëminently a streptococcus disease. The symptoms are those of general peritonitis from other causes. The most striking symptom is the extreme degree of meteorism which results from intestinal paresis, and which produces compression of the thorax and dyspnea. The prodigious amount of toxins produced and absorbed tends to overwhelm the heart, and the pulse-rate rapidly mounts to the neighborhood of 150. Ahlfeld regards malignant peritonitis as essentially a disease of the very early puerperium—most frequently of the first day. The chill is often wanting, and the rapid supervention of great agony referred to the bowels; vomiting, restlessness, and anxiety suggest that the patient has swallowed an irritant

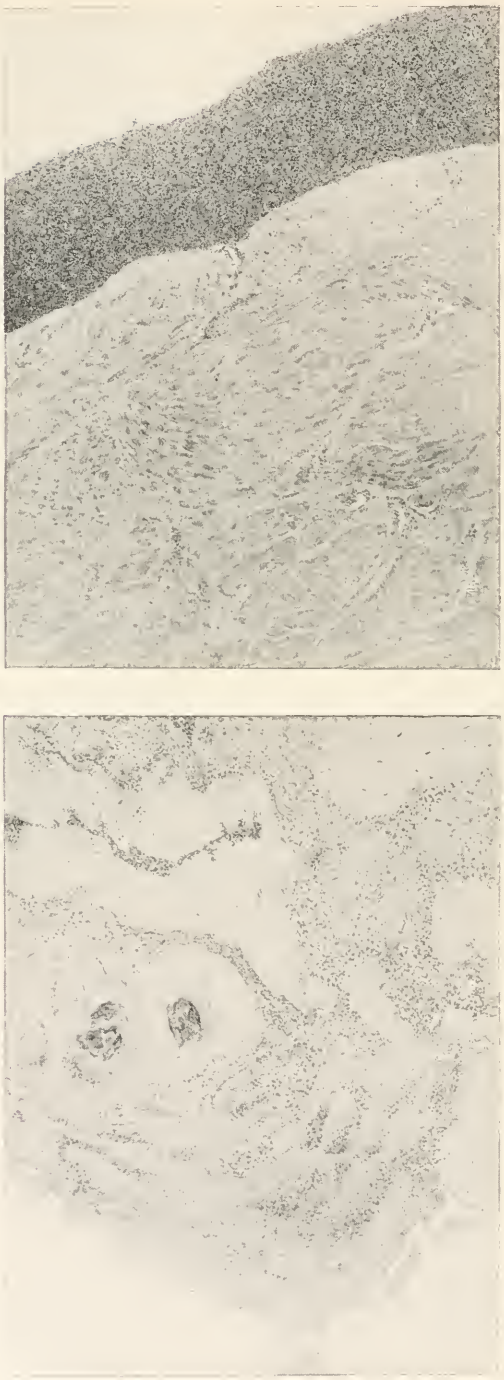


FIG. 956.—SECTION THROUGH THE WALL OF A UTERUS SHOWING STREPTOCOCCUS ENDOMETRITIS, AND EXTENSION OF THE INFECTION THROUGH THE LYMPHATICS TO THE PERITONEUM, CAUSING PERITONITIS. Death on the thirteenth day post partum, after a full-term delivery, from general purulent peritonitis and exhaustion. Patient was at first treated on the basis of a diagnosis of acute malarial infection. No local treatment was at any time used. × 75.—(*From a specimen in the Pathological Laboratory of Cornell University Medical College.*)

poison. Lenhartz, however, described an entirely different course, in which the puerperium begins favorably, then parametritis develops, and eventually general peritonitis; the evolution of the disease being much less fulminant. He found the symptoms to occur in the following order: chill (always present); vomiting; abdominal pain; diarrhea. These were succeeded by great weakness and meteorism. All authors speak of the euphoria and mental clearness which are sometimes presented by women who are already nearly pulseless. They no longer feel pain nor distress. As the symptomatology of this condition agrees with that of acute general peritonitis from other causes, further details may be omitted.

The *diagnosis* should be self-evident and the *prognosis* is all but hopeless. Since occasional recoveries occur, the selection of favorable cases becomes of great importance. As the bacteria spread over the peritoneum and proliferate, with production of toxins, a serofibrinous exudate appears which tends to become purulent.

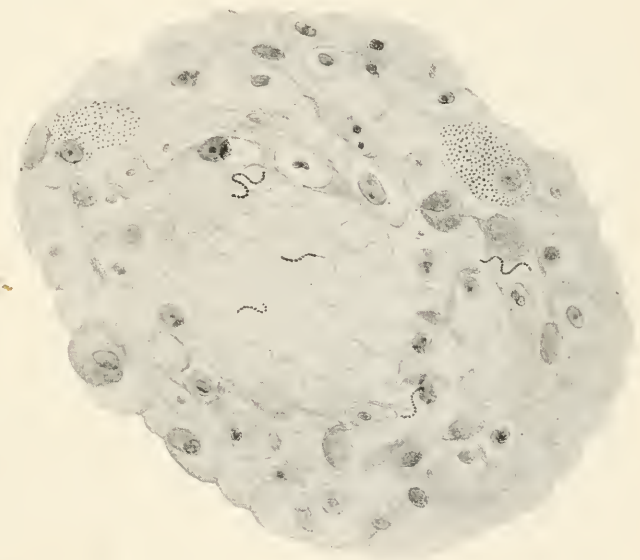


FIG. 957.—SMALL BLOOD-VESSEL FROM THE ENDOMETRIUM OF FIG. 956, SHOWING STREPTOCOCCI AMONG THE BLOOD AND ENDOTHELIAL CELLS. × 700.

Consecutive Lesions from Venous Extension.

XII. Metrophlebitis, Septic Phlebitis, or Septicæmia Venosa. — The microorganisms which cause infection may gain access to the circulation in two ways: by the lymphatics (Fig. 956), as already noticed, and by the veins (Figs. 937, 938). The placental site is naturally most likely to be the starting-point of the latter process. The diffusion through the general circulation of pyogenic organisms and the transportation of these organisms to distant tissues and organs give rise to a long train of symptoms and complications which are usually grouped under the name pyemia. Some of these complications, however, may occur as the result of other varieties of sepsis; *e. g.*, endocarditis is sometimes seen in connection with the lymphatic form of sepsis and arthritis may occur when the infection is due to gonorrhea.

UTERINE AND PARA-UTERINE PHLEBITIS.—*Pathology:* Thrombosis of the uterine or pelvic veins is not a rare occurrence (Fig. 978). Uterine re-relaxation predisposes to its development. Normally a thrombus becomes organized and converted into an impervious cord of tissue, or a channel may be formed and the circulation re-established. When a thrombus becomes infected, which naturally happens most frequently at the placental site, it disintegrates, and fragments may be carried to distant parts of the body. Septic phlebitis may occur when the vessel is surrounded by infected tissue.

In this case the endothelium proliferates and thrombi occur. Thrombi resulting from phlebitis may remain organized, but usually become purulent; and we then have abscesses in the uterine wall and the extension of the process along the veins of the pelvis. When in a case of endometritis the necrosed endometrium at the placental site is removed, the thrombi are found to be but little affected. Extension of endometrial infection along the placental thrombi does not ordinarily occur. Organization of the thrombi is to be regarded as Nature's safeguard against infection, and probably organization in the deeper layers has already occurred before labor. When, however, the organisms possess a high degree of virulence, or when they gain access to the placental sinuses before or early in the course of labor, the thrombi remain soft and permit the propagation of the bacteria, and cases of severe infection may be marked by the breaking-up of thrombi already organized.

Etiology: The usual causes of sepsis are, of course, operative. Manipulations about the placental site seem to constitute a predisposing cause. This type of infection has often been noticed in sepsis from retained placenta, in cases of placenta prævia, and after manual separation of the placenta. Infection occurring early in labor, before the organization of the placental thrombi, is especially apt to result in uterine phlebitis. *Symptoms:* These generally appear rather late in the puerperium, perhaps at the end of a week or two, although they have been noted three or four days after delivery and as late as three weeks and more. There is a sudden rise of temperature to 103° or 105° F., and the pulse becomes rapid. A chill is not usually present. The fever soon becomes remittent or intermittent, profuse sweats occur at intervals, and there are evidences of great prostration. *Diagnosis:* Bimanual examination shows no subinvolution or special sensitiveness or exudation as in pelvic peritonitis or cellulitis. In some cases sudden and severe hemorrhage may occur from the disintegration and dislodgment of infected thrombi. The diagnosis is based upon the symptoms mentioned above, together with the negative results upon external and bimanual examination. *Prognosis:* This is grave, not only on account of the danger inherent in the condition, but of the various complications which may ensue in the course of a metastatic pyemia.

Femoral Phlebitis, or Phlegmasia Alba Dolens.—This condition is still called "milk-leg" by the laity, and was formerly supposed to be due to metastasis of milk. It is characterized by venous obstruction and enormous swelling of the leg. *Pathology:* It occurs in two forms—the *thrombo-phlebitic* and the *cellulitic*. The first is much more common. The two varieties may be combined, since a phlebitis may lead to inflammation of surrounding structures, and, vice versa, a cellulitis may cause phlebitis or thrombosis. The student will notice that phlegmasia may occur as a complication either of uterine phlebitis or of cellulitis—much more commonly, however, of the former. The *thrombo-phlebitic* form may arise in two ways: either by the extension of a septic inflammation of the walls of the vessel from the placental site, with resulting clotting of blood in the vessel, or by primary thrombosis. According to Widal, micro-organisms are especially prone to attack the wall of the femoral vein near Poupart's ligament, the circulation being notably sluggish at this point, and particularly so when the patient first assumes the erect position after delivery. *Etiology:* The condition is usually to be regarded as a result of septic infection. The method of extension is made clear by the pathology. It is possible that it is occasionally non-septic in origin. Among the causes which may predispose to non-septic thrombosis may be mentioned slowing of the circulation, as in varicose veins. *Symptoms:* In the *thrombo-*

phlebitic form the symptoms usually appear two or three weeks after delivery, and often after the patient has been up for a few days. As in other forms of infectious phlebitis, there are fever and perhaps chilly sensations and a chill. The tongue is coated and there are evidences of gastro-intestinal disturbance, loss of appetite, constipation, eructations, nausea, and vomiting. There is a feeling of weight and stiffness in the leg. Pain in the calf of the leg is often a prominent symptom. There may be tenderness along the course of the femoral vein which may be marked by a red line. Sometimes other superficial veins present similar signs. The leg swells rapidly from below upward and soon attains an enormous size. When the swelling is at its height, the skin is so tense as not to pit on pressure. In the *cellulitic form* the symptoms are in many respects similar, but the swelling is from above downward and there are the accompanying evidences and previous history of pelvic cellulitis. The left leg is affected oftener than the right. In some instances though beginning in one leg, the other after a brief interval is also affected.

The foregoing lesions have been considered because they frequently occur in cases of metastatic pyemia, but it is easy to see that the list might be indefinitely multiplied. Wherever an infected embolus finds lodgment, metastatic abscesses may occur. The liver, kidneys, and spleen, and even the brain and eye, have been so affected. Parotitis has been observed; multiple abscesses in the muscles and connective tissue and diffuse cellulitis may occur. Pleuritis and pericarditis are common.

XIII. Specific Diseases.—ORIGINATING INTRAGENITALLY.—Here belong three diseases which are capable of producing diffuse primary inflammation of the genital passages, followed by toxemia or bacteriemia. The disease is contracted in most cases from an individual having the same affection; and herein it differs from ordinary infection, which does not represent the extension of a specific infectious disease. (1) *Gonorrhea:* According to Ahlfeld, the gonococcus is found with surprising frequency in the vaginal secretions of a pregnant woman. It is, however, usually present in small numbers. (Fig. 947.) But after delivery we may find in the same subject that the number has greatly augmented. This rule is believed to hold good for the endometrium, tubes, and peritoneum; so that when a puerpera develops clinical gonorrhea, we are not to think first of an infection from without. The latter, however, is possible; obstetricians do not usually describe a puerperal gonorrheal vulvitis or vaginitis, although such might readily occur under conditions of exposure. Infection of the newly born usually arises from endocervicitis. A puerpera with pre-existing gonorrheal endometritis, salpingitis, etc., may develop fever from gonococcus toxins or very rarely actual gonococcus sepsis with metastases. (2) *Diphtheria:* True diphtheria may occur in the vulva and vagina, either in patches upon wounds made in delivery, or as a continuous membrane. It may represent a primary inoculation or be secondary to faucial diphtheria. High temperature and other accidents due to toxemia occur, but sepsis is excluded by the nature of the disease, which readily yields to antitoxin. (3) *Erysipelas:* It has usually been believed that a puerperal woman exposed to erysipelas contracts ordinary puerperal fever, owing to the apparent identity of the streptococcus erysipelatis and streptococcus pyogenes. However, these women sometimes contract true erysipelas which begins in the cutaneous aspect of the vulva. Some authors mention a diffuse inflammation of the genital tract. Ahlfeld mentions an erysipelatous inoculation of birth-traumatisms. Good descriptions of all these focal affections are difficult to find in literature. We may expect to see bacteriemia develop in these cases. Whenever a puerpera is attacked by ordinary

facial erysipelas, we do not usually see an implication of the genitals. (4) *Miscellaneous:* Theoretically any infectious bacterium might set up local intragenital lesions in the puerpera. The bacillus of tetanus produces no known local alteration in the puerperium; hence this condition may be discussed under toxemia. When germs like the bacillus coli and pneumococcus cause focal affections they are indistinguishable save by the microscope and by cultures from ordinary pyogenic infection.

Originating Extragenitally.—Of the acute infectious diseases, a certain number tend to cause focal affections of the genitals; so that if a puerpera should contract one of these diseases we naturally expect to see the formation of hematogenous genital lesions. Thus cholera and other severe diseases produce endometritis, which, occurring in the recent puerperal uterus, might readily cause hemorrhage. (Vinay mentions only a single case of post-partum hemorrhage in connection with puerperal cholera.) Variola should give rise to a specific vaginitis as well.

Metastatic Focal Infection.

Metastatic Lesions.—These develop only after the establishment of bacteriemia, with which they are necessarily associated. Speaking generally, when a woman has once become septic her condition should not differ materially from that of septic patients in general; and the subject of metastases might well be left to general treatises on pathology. Most authors describe some of the more commonly occurring and important metastases in this connection, such as endocarditis, pneumonia, various dermatoses, etc. According to Lenhartz, pulmonary abscesses, as a rule, represent the only form of suppurative metastasis; next in frequency come intramuscular and intra-articular or periarticular lesions, affecting by preference the knee. Very rare metastases are those of the eye (panophthalmitis) and meninges. Other metastases are renal and splenic infarcts, cutaneous hemorrhages, and pustular eruptions. An important lesion of sepsis not always classed among ordinary metastases is endocarditis, which is in itself responsible for metastases of the eye, meninges, etc.

BLOOD-STATES OR GENERAL CONDITIONS.

Simple Blood-state or General Condition.

I. Sapremia.—Sapremia is a blood or general state characterized by the absorption of decomposition-products of putrefying tissue. While often spoken of indifferently as toxemia, it is of a different character from the toxemia of bacterial origin. While the saprophytes, which set in motion the putrefactive changes in the dead tissue, secrete poisonous substances, these must be greatly overshadowed in importance by the decomposition products of the tissues themselves. Sapremia is therefore a sort of ptomainemia. The substances which by their decomposition furnish these toxic substances are varied, comprising retained placenta and decidua, pent-up lochia, the retained ovum or fetus in missed labor, portions of gangrenous uterus, fibroid tumors, etc., etc. The necrotic surface of puerperal ulcers is also a source of sapremic intoxication, and according to some authorities, this is even true of the tissue cast off during normal regeneration of the endometrium.

Lenhartz believes that pure sapremia is not so frequent as has been believed, and that a bacteriemia often coexists. Clinically the phenomena of sapremia depend upon the amount of poisonous matter absorbed. In the most fulminant cases we see the picture of a most intense toxemia. There is a chill, followed by high fever, headache, vomiting, and complication of the higher nervous

centers, as shown by motor excitement and delirium. Meteorism is present, as a rule, so that the dyspnea of fever is increased. The pulse may reach 160. In the most fulminant forms the patient may die in the first twenty-four or forty-eight hours or she may linger for one or two weeks. There is, as a rule, no tendency to compromise permanently important organs, so that in pure sapremia striking improvement follows the removal of the putrefying material. In fatal cases the same alterations are found as in non-metastatic septicemia.

Every degree of sapremia may be encountered between the acute fulminant type and the "one-day" or even "one-hour" rise of temperature seen in a large proportion of normal puerpera.

Of considerable interest in this connection is the possibility of a different type of sapremia due to intestinal resorption incidental to the prolonged constipation of the puerperal week when the bowels are not artificially relieved. In cases in which the woman's bowels have not been relieved before delivery, this species of sapremia might antedate labor. It is true that Kustner and Zangemeister have apparently shown independently that constipation on one hand, and the routine use of castor oil on the other, have no effect on the temperature of the puerpera, which when elevated must be due to sapremia from the uterus. But a few experiments made perhaps upon phlegmatic peasants will hardly convince American practitioners that women in this country do not develop a rise of temperature in many cases when the bowels are confined and distended with gas. It is true that toxemia of intestinal origin (stercoremia) may not be the cause of rise of temperature, for the latter may be due to reflex excitation of the heat center by the distended bowels.

II. Bacterial Toxemia.—Pure Toxemia of Bacterial Origin.—This condition frequently accompanies the puerperium, where it may be caused by the ordinary pyogenic cocci, and exceptionally by the tetanus bacillus, Klebs-Loeffler bacillus, etc.

Pyogenic Cocci.—Wherever there is an acute local suppurating focus in the puerperal genitals, we almost invariably see the development of the toxemia, which is a feature of the ordinary surgical or wound fever. While this may readily be complicated by sapremia, whenever necrosis or imperfect drainage leads to putrefactive changes, a pure toxemia is of common occurrence, especially in abscess formation, or wherever saprophytes may be excluded. Walthard and others have made the claim that the streptococcus itself, when of low virulence, may act as a saprophyte, feeding on dead tissue only and setting up sapremia in addition to the secretion of its proper toxins. He thus holds the streptococcus responsible for some of the mild resorption fever which is present in a normal puerperium. Such a condition would naturally belong to sapremia. It is otherwise, however, in some of the severe focal affections of the puerperium. Thus in a pure streptococcus endometritis with an efficient leucocyte barrier against extension by the lymphatics; in a parametritic abscess; in local suppurative peritonitis, and even in some cases of fatal general peritonitis, the accompanying blood-state is a pure toxemia without any evidence of bacteriemia, whether bacteriological or clinical. It is therefore a mistake to speak of such affections as varieties of sepsis. They represent only toxemia, although very prone to lead to sepsis. In a certain class of cases the bacteria reach the blood, yet clinically the condition is still a toxemia. In the majority of cases of bacterial toxemia, recovery is the rule, whether or not abscess-formation occurs. An exception is furnished by acute general peritonitis, owing to the great extent of surface involved, and the fatal degree of the toxemia, which overwhelms the heart.

Puerperal gonorrhea may be accompanied by toxemia, rarely by bacteriemia as well (gonococcus-sepsis).

The suppurative focus may be extragenital. This is illustrated by mastitis developing near term, the toxemia extending into the puerperium.

Bacterial Toxemia of Tetanus.—It is well known that the tetanus bacillus sometimes reaches the uterus, not only from direct transportation (usually in connection with attempts at criminal abortion), but in purely spontaneous labors in unexamined women. The tetanus germ does not induce any local lesion, but its toxins, formed *in situ*, are absorbed with the production of the full clinical picture of tetanus. Sapremia or sepsis or both may of course coexist. Vinay has reported 106 cases, in 37 of which there had been operative interference. Hirst has reported three cases in which the disease was apparently due to injections of unboiled river-water. According to Heyse, a previous septic infection is always necessary to pave the way for the tetanus bacillus. This claim has, however, been denied. The *symptoms* and *etiology* are practically those of tetanus in the non-pregnant state. Premature emptying of the uterus seems to be a predisposing cause, since the disease develops oftener under these circumstances than after labor at full term. In my study of 635 cases of premature interruption of pregnancy, no tetanus occurred. The *diagnosis* can present little difficulty, although the affection has been confounded with hysteria. The condition is usually fatal.

Bacterial Toxemia of Diphtheria.—This occurs in primary diphtheria of the puerperal genitals, in ordinary diphtheritic angina, etc., as a concurrent affection. Unless some associate infection or intoxication is present, we have the pure toxemia which characterizes simple diphtheria.

Puerperal Toxic Erythema.—As already mentioned, an erythematous rash is not infrequently noticed during the puerperium. It may occur in cases of profound toxemia or in mild cases. Its principal importance is that it has been frequently mistaken for scarlet fever. I have in three instances been asked to see cases of so-called puerperal scarlatina which proved to be septic erythema. In one case the patient was about to be transferred to the Hospital for Contagious Diseases. The rash is attended by itching and sometimes by desquamation. It is usually regarded as due to Nature's effort to eliminate toxic materials by the skin. (See Fever Due to Intercurrent and Complicating Diseases.)

Puerperal Pemphigus.—Very rarely the occurrence of a pemphigoid eruption in connection with mild cases of sepsis has been noted. The fact that it spreads rapidly through a lying-in ward indicates a specific infection of some kind. Isolation and the treatment of the coexisting sepsis are of course indicated.

Puerperal Toxic Neuritis.—This has been described by Möbius, Laury, and others. It may occur in the course of a general toxemia, and most commonly affects the arms, taking the form of a bilateral median and ulnar neuritis, but the involvement of many other nerves has been noticed. The spinal cord may be affected. In other cases it may be the result of direct extension of the infectious process, as in cases of pelvic exudation. There is also a non-toxic variety, due to pressure upon the nerve structures by the fetal head, the gravid uterus, or instruments. It is most likely to occur in cases of pelvic deformity. (See page 769.) The symptoms and diagnosis are the same as in the non-puerperal condition together with those of coexisting toxemia.

This affection must not be confounded with polyneuritis due to the toxemia of pregnancy, which may extend into or develop during the puerperium.

III. Pure Bacteriemia.—This condition denotes the presence of bacteria in

the blood without the association of bacterial toxins. Naturally the bacteria must be of very low virulence. Pure bacteriemia has been found on several occasions by Lenhartz in blood examinations made in connection with endocarditis. Despite the constant presence of streptococci in the blood for weeks and even months, no further symptoms were produced, and the temperature was practically within normal limits. Pure bacteriemia must occur occasionally in the puerperium, as shown in cases of uncomplicated endocarditis, following slight genital lesions. In the vast majority of cases, bacteriemia is associated with toxemia, constituting septicemia.

Composite or Septic Blood-states or General Conditions.

IV. Bacteriemia with Toxemia.—1. Septicemia.—Septicemia is a blood or general condition characterized by (*a*) bacteriemia and toxemia; (*b*) certain clinical phenomena; and (*c*) certain post-mortem findings. Bacteria cannot always be obtained from the blood, but their presence therein is assumed if the other conditions are in evidence. When metastatic lesions are present we have a special clinical or anatomical variety, but metastases do not necessarily occur. Endocarditis when it develops is not usually counted as a metastasis, but a complication which is itself a cause of metastatic foci.

In non-metastatic septicemia the post-mortem lesions are slight, and confined to cloudy swelling of the kidneys, liver, and heart, with an enlarged and relaxed spleen. Clinically septicemia may be ushered in with a chill, followed by high fever of remittent type; or it may develop in a most insidious manner, the temperature rising gradually. The pulse-rate varies with the temperature and may reach 150. There are great prostration and a cyanotic pallor. The disease may be malignant from the start, destroying life in a few days or a fortnight or it may extend over many weeks. Clinically it is usually accompanied by severe focal affections. From these primary foci the bacteria and toxins continue to enter the blood by the lymphatic route; hence the course and prognosis depend somewhat on the progress of the primary lesion. In a certain proportion of cases endocarditis develops, while in others true metastases occur. These elements also exert great influence over the ultimate outcome of the disease.

Sepsis with endocarditis and metastatic sepsis do not differ from those affections in non-puerperal subjects and need not be dwelt upon.

In the narrower sense of the term, puerperal sepsis is due to the ordinary pus-exciters, principally the streptococcus. Sepsis due to the staphylococcus, bacillus coli, pneumococcus, etc., also occurs, as well as does mixed infection. Septicemia of a character similar to the ordinary streptococcus type might be associated with puerperal scarlatina and erysipelas; also with gonorrhea.

Septicemia in the wider sense of the term, not due to the familiar pyogenic bacteria, may occur in the puerperium. Here would belong typhoid fever and acute general tuberculosis.

2. Pyemia.—Pyemia is merely a form of septicemia which follows phlebitis and suppuration of thrombi. The peculiarity of the primary lesion leads to clinical and anatomical peculiarities, for large amounts of bacterial toxins have ready and repeated access to the blood, as do likewise pus corpuscles and portions of infected thrombi. In ordinary septicemia, when pus enters the blood it is usually as a result of secondary ulcerative endocarditis; while in pyemia, the pus proceeds directly from the infected uterine sinuses. Ulcerative endocarditis is also very common in pyemia. Generally speaking, no absolute distinction can be made between the blood-states in pyemia and septicemia.

Pyemia, like septicemia, may run a fulminant or a subacute course. In the first place the large amount of toxins which enter the blood gives the disease the character of a severe toxemia which may be fatal before metastases are in evidence; in the subacute form, toxemia is less marked and metastatic complications may succeed one another.

As a rule, pyemia is characterized by repeated chills, which may occur daily, sometimes to the extent of several in a day. The fever curve is irregular and either intermittent or remittent. In acute cases the symptoms resemble those of acute septicemia; in fact there is no essential difference between the two states. (See Metastatic Focal Affections.)

3. Septicopyemia.—This term is sometimes used to denote a special blood-state, which is said to be inevitably fatal, but it does not appear just what is meant by the term septicopyemia. In former years it was evidently used as an equivalent for pyemia. Following modern terminology we shall restrict the term to cases in which the blood is infected by the venous and lymphatic routes combined. Thus Trendelenburg found that in forty-three fatal cases of puerperal fever there were eighteen cases of septicemia, twenty-one cases of pyemia, and four of combined lymphatic and venous infection (septicopyemia). Clinically such a condition may be regarded as a pyemia.

V. Sapremic Sepsis, including Gas Sepsis.—Sepsis representing an association of bacteriemia and toxemia, the term sapremic sepsis may be used to denote several conditions. Thus, in simple sapremia of a fulminating type, the saprophytes may be found in the blood during life, as shown by Lenhartz. Ordinarily, however, the expression sapremic sepsis would imply a mixed or associate condition, in which ordinary septicemia or pyemia is associated with sapremia from putrefaction of the uterine contents and perhaps of the endometrium itself. Such a condition is overwhelmingly toxic, because the blood contains both bacterial toxins and the products of putrefaction. It represents a severe and fulminant type of disease, and one which should be essentially malignant. Recovery may occur, however; Lenhartz's case No. 48 represents a sapremic sepsis in which sapremia was associated with bacillus coli bacteriemia. The bacterium disappeared from the blood as the case progressed to recovery. In such cases of mixed infection removal of putrescible material from the uterus is not necessarily followed by improvement in the lochial discharge, which may remain offensive for days, signifying that the endometrium itself is the seat of putrescence. Doubtless this severe involvement of the endometrium—mixed putrid and pyogenic endometritis—is responsible for the associated implication of the blood. Another still more formidable type of sapremic sepsis is the so-called "gas sepsis"—a condition which is rare and not fully understood. It is known that most of the saprophytes which attack the tissues after death, or gangrenous tissue during life, generate gases which may or may not be fetid. Some saprophytes, such as the bacillus aërogenes capsulatus, and bacillus phlegmones emphysematosæ, appear to be able to attack living tissues and form gas. But the so-called *tympania uteri* may be due to a variety of causes, and the part played by bacteria is not well defined. In many cases which end fatally, it is not easy to decide whether the gas-forming bacteria have attacked the tissues before or after death. It is admitted, however, that in some of the severest forms of putrid or mixed endometritis, gas-forming saprophytes may attack the uterus during life and also set up a gas-bacteriemia and gas-forming metastatic lesions. In most of such cases ordinary septicemia or pyemia coexists.

General Conditions with Anomalies of Temperature.

VI. Simple Hyperthermia.—This condition, also known as *pseudo-fever*, consists, as its name implies, of a simple elevation of temperature without any of the collateral phenomena of true fever. It has been noticed under a variety of circumstances, and is due apparently to a variety of causes. Slight elevation of temperature may follow a hot bath. Rise of temperature has been produced by suggestion, and by mere nervous excitement. The thermal center is doubtless under the influence of emotional and reflex excitation in subjects with nervous instability. When we remember that the latter condition is common in the pregnant woman and can hardly disappear at once after delivery, it should not surprise us to see paradoxical elevations of temperature in the puerpera. Not only do we find simple hyperthermia in the presence of nervous excitement and physical discomfort (constipation); but even in sapremia up to a certain degree, rise of temperature is not attended with collateral evidences of fever. Simple hyperthermia is not of long duration, as a rule.

Caution.—It is to be hoped that the student will not infer from the list of possible causes of fever which I mention that any of them, except perhaps the constipation and reflex influences, are at all common during the puerperium. The undoubted possibility of their occurrence, however, makes it incumbent upon the physician in every doubtful case carefully to search for the evidences of acute or chronic disease, just as he would in any patient and at any time. Typhoid fever and malaria, especially the latter, have been convenient names by which to designate the results of improper management of labor and the puerperium. When the practitioner realizes that he should either wear sterile rubber gloves or disinfect his hands and arms as carefully for a vaginal examination as for a laparotomy; that vaginal examinations should be as infrequent as possible, and should be preceded by careful cleansing of the vulva and that all unnecessary manipulations should be avoided after delivery,—he will find that fever, except transient rises of temperature from constipation and reflex causes, will be of the rarest occurrence, and that he will seldom be called upon to make the differential diagnosis between puerperal sepsis and other febrile affections.

Some difficulty arises in classifying the causes of pseudo-fever, since in some cases the fever is of reflex origin, while in others it is not so or only in part reflex in character. I believe, however, that the following arrangement will be of service in enabling the student to recall and to differentiate the different kinds of fever.

1. Constipation.—That constipation may cause a rise of temperature during the puerperium is a matter of everyday experience (Fig. 959). Doubtless this fever is partly reflex in character from the distention of the bowel and consequent local discomfort, but it is also toxic, as shown by the headache and general malaise which accompany it. This condition was recognized and described by Gilman, Schroeder, Roswell Park, and others, as the result of the absorption of products of decomposition. It is not peculiar to the puerperium, but there is, at this time, a special predisposition to it, on account of the accumulation of feces in the later weeks of pregnancy and the sluggish intestinal action during the puerperium, the causes of which have already been considered. It is also a well-known fact that a prolonged recumbent posture predisposes to obstinate constipation. The *treatment* consists in the proper regulation of the bowels during the later weeks of pregnancy, by attention to the diet, and the administration of a laxative on the evening of the second

or morning of the third puerperal day, followed, if necessary, by an enema. (See Management of the Puerperium and Diet of the Puerperal Woman, pages 688 to 698.) In the presence of fever or headache, reasonably attributable to constipation, the prompt administration of a saline cathartic is indicated. It is wise, however, not to wait for the action of a cathartic, but to give at once a copious enema of soapsuds. Subsequent attention to diet is important.

2. **Hyperthermia from Reflex Irritation.**—That a sharp but usually transient rise of temperature may be produced by reflex irritation is a fact with which the obstetrician soon becomes familiar (Fig. 961). In this case the fever is, without doubt, due to the effect of the exciting cause upon the nervous system, but the *modus operandi* is largely a matter of speculation, and need not be discussed here. It is a matter of clinical experience, however, that the circumstances attendant upon pregnancy, labor, and the puerperium, tend, especially in patients of the neurotic type, to an exaggeration of reflex nervous excitability. Fever of reflex origin is usually to be traced to some source of pain or discomfort purely physical in character, and not of infectious origin. The most frequent source of trouble in this respect is overdistention of the breasts with milk. 1. Mammary Irritation: Among the sources of reflex irritation, distention of the breasts is perhaps the most frequent and important. The so-called "milk fever" of the older writers has already been alluded to, and is now regarded as obsolete, but it is nevertheless true that the extreme and painful distention which sometimes occurs with the establishment of the milk secretion may, and frequently does, cause a considerable rise of temperature, which promptly subsides with the disappearance of the cause (Fig. 961). *Diagnosis:* Fever resulting from overdistention of the breasts is to be distinguished from septic infection of the genital tract by determining the fact of overdistention of the breasts and its resulting discomfort, by the fact that the fever is of short duration, disappearing with the removal of the cause. The various kinds of infection may be excluded by the methods described in connection with the diagnosis of the different varieties of sepsis, but this will not usually be necessary. Especial care should, however, be taken not to mistake a beginning mastitis for overdistention of the breast, since the treatment of these conditions is radically different, and a mistake is likely to result disastrously for the patient. The diagnosis of mastitis is considered elsewhere (page 762). As regards *treatment*, the child should be put to the breast and the surplus amount of milk removed, if necessary by the breast-pump, or better by gentle massage under hot stupes; but all rough handling of the breast must be avoided. If necessary, a saline cathartic may be given and the amount of fluids, especially milk, limited for a time. A properly applied breast bandage may be a source of comfort to the patient. Abscess of the breast is considered elsewhere as a form of local sepsis. 2. Sore Nipples: The pain attending a cracked or fissured nipple, especially during nursing, may cause a transient rise of temperature, although in such a case we would ordinarily suspect infection through the nipple (Fig. 971). 3. Rupture of the Uterus: Among the causes of fever which may be regarded as purely reflex in character, may be noted the rise of temperature which may almost immediately follow uterine rupture. Although fever due to septic peritonitis and other infectious conditions may, of course, follow later, it seems reasonable to ascribe the first rise of temperature to reflex irritation. 4. Retrodisplacements of the Puerperal Uterus: A rise of temperature due to this cause and promptly disappearing after replacement I have observed as late as the fourth week.

It is obvious that the list of possible causes of non-septic fever may be indefinitely extended. Colic, the peristaltic action evoked by cathartics, the discomfort attending the passage of hard fecal masses, or the prolonged retention of urine, might cause, in patients of the neurotic type, a fever, disappearing promptly with the removal of the cause. Exposure to cold is an occasional cause, and I have observed fever, excitement, and neurotic symptoms late in the puerperium from the presence of a tapeworm, which was subsequently secured.

3. Hyperthermia from Neurotic Conditions.—The possible occurrence of fever as the result of organic nervous disease has already been noted. It remains to

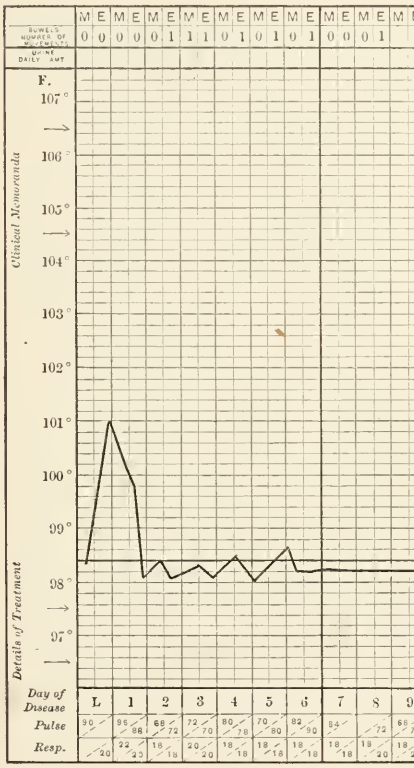


FIG. 958.—POST-OPERATIVE FEVER FOLLOWING CRANIOTOMY.

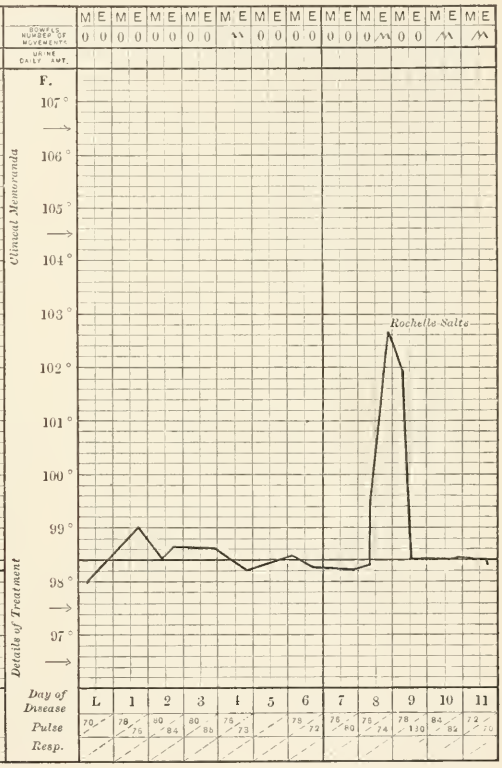


FIG. 959.—FEVER DUE TO CONSTIPATION ON THE NINTH DAY OF THE PUERPERIUM.

notice the rôle played by functional neuroses in the production of fever during the puerperium. EMOTIONAL EXCITEMENT: This frequently causes a transient rise of temperature. Fright, grief, anger, excessive annoyance from any cause, may have this effect. As in the case of reflex irritation from causes purely physical, the *modus operandi* is not well understood. These cases are most likely to occur in patients of the neurotic type. HYSTERIA: The occasional, though very rare, occurrence of sustained high temperature in hysterical cases cannot be doubted. The diagnosis is to be made by eliminating the various forms of sepsis, by the previous history of the patient, and by the absence of the general symptoms due to septic infection. The *treatment* is

obvious. During the puerperal period all visitors except the patient's mother or husband should be excluded, and every source of annoyance and excitement eliminated as far as possible. The importance of securing for the patient a sufficient amount of undisturbed sleep has been referred to in connection with the management of the puerperium, and cannot be overestimated. In cases of hysteria, in addition to measures adapted to the *morale* and surroundings, the bromides and other nerve sedatives will be of service.

VII. True Fever.—True fever is characterized by a number of phenomena, of which hyperthermia is the chief. It begins in general with a precursory hypothermia, sometimes expressed by chilliness or rigors, and after its establish-

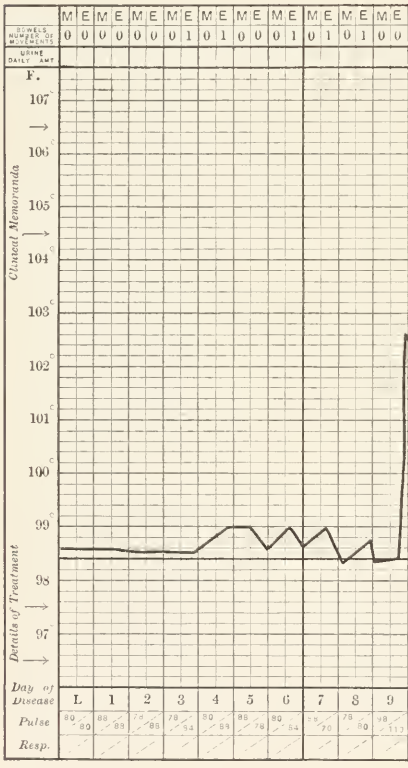


Fig. 960.—Fever due to Epidemic Influenza.

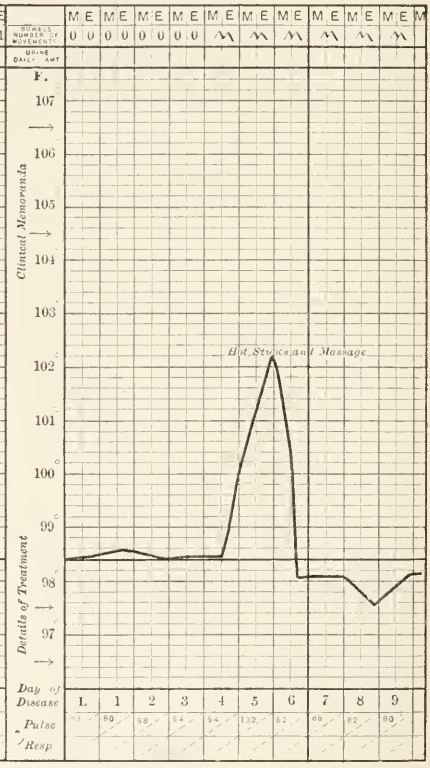


Fig. 961.—Fever due to Reflex Irritation of Caked Breasts. Relieved by massage through hot stupes.

ment pursues a certain course with intermissions or remissions. In most cases it is due to a toxic principle in the blood, which is akin to the albumoses. An albumose-reaction can be obtained from febrile urine in the majority of cases. This substance, while affecting the heat center, also acts upon the vasomotor center as well, so that fever is accompanied by circulatory phenomena, chiefly local congestions. Since true fever is due to the action of a toxin, we find it associated as a rule with malaise, headache, pain in the limbs, anorexia and other evidences of toxemia. The pulse-rate increases, as a rule, with the temperature. A certain group of symptoms is caused by the persistent high temperature and increased interchange of gases, as thirst, dryness of the mouth,

scanty urine, etc. In the puerperium it is important to discriminate between mere hyperthermia and true fever, for the former, as a rule, requires no intervention directed to the uterus. The fever of sapremia, toxemia, septicemia, etc., is essentially one and the same, being due either to products of putrefaction or bacterial toxins, both classes of substances being akin to toxalbumoses.

VIII. Hypothermia.—Hyperthermia and fever do not necessarily accompany the blood-intoxications and infections of puerperal morbidity. Instead we may encounter hypothermia, under which term we may, for simplicity's sake, include normal temperatures when present in severe systemic affections. Lenhartz states that hypothermia is known to occur under three conditions. 1. Severe collapse or adynamia such as complicates perforation of the uterus and peritoneum (as an accident of forceps delivery). He relates a typical case in which a woman lived for seven days without rise of temperature, a feeble elevation occurring just before death. 2. Subfebrile periods in ordinary cases of sepsis. These occur under various circumstances. Thus in a case of what proved to be combined putrid and infectious endometritis, emptying the uterus resulted in four days of normal temperature, after which pyogenic endometritis asserted itself with fatal sepsis. When pyemia leads to secondary suppurative foci in the joints, empyema, etc., evacuation of the pus may be followed for a time by normal or subnormal temperature. 3. Terminal hypothermia. This phenomenon is sometimes seen just before death in severe cases of sepsis or pyemia.

(D) CLINICAL TYPES OF PUERPERAL MORBIDITY.

Introduction.—Without a definite understanding of the various focal affections and blood conditions, it is impossible to understand the clinical pictures which puerperal morbidity may assume. The number of these conditions is very large, although they readily fall into certain categories. Thus we may have certain local lesions with little or no general reaction, and general sepsis with but little local disturbance. We may have local putrefaction of dead tissue associated with sapremia; local suppuration (abscess) with toxemia (fever of suppuration); local inflammation with bacterio-toxemia; metrophlebitis with so-called pyemia; various combinations of the preceding, etc.

The General Symptoms of Puerperal Infection.—There are certain symptoms common to most cases. The most prominent of these is *fever*. An elevation of temperature, commonly occurring about the third day, is usually the first sign that attracts attention. The *pulse* is increased in frequency, and when the increase is not in proportion to the amount of fever, we have a valuable diagnostic symptom. In puerperal sepsis the pulse ratio is greater than with fever due to other causes. Liebermeister * gives the pulse-rates which should result from corresponding temperature markings: Temperature 98.6° F., pulse-rate 78; temperature 100.4° F., pulse-rate 88; temperature 102.2° F., pulse-rate 97; temperature 104° F., pulse-rate 105; temperature 105° F., pulse-rate 109; temperature 107° F., pulse-rate 121. A *chill* or chilly sensation may be present, but is frequently absent, especially in the milder types of infection. It may, however, be present in any variety of sepsis, and is not necessarily indicative of metastasis, as it was at one time thought. *Pain and tenderness* in the pelvis are not constant symptoms, and the same may be said of *distention of the abdomen* due to paralysis and consequent relaxation of the intestines, of nausea and vomiting, a coated tongue, constipation or diarrhea, special changes in the

* "Vorlesungen über specielle Pathologie und Therapie," Band III.

urine, sleeplessness, and delirium. *Headache* is a prominent symptom, as are disturbances in the process of involution, shown by a soft, flabby uterus. Diminution in the quantity of the *lochia*, especially for twenty-four or forty-eight hours at the outset of the attack, is quite constant, but a marked foul odor to the lochia, except in cases of retained secundines, is not necessarily present. Foul odor is often absent in the severest types of puerperal sepsis.

I would give the following symptoms as most pathognomonic of the various types of puerperal sepsis, aside from a bacteriological examination of the blood and the secretions of the genital tract: (1) Fever; (2) increase in pulse-rate out of proportion to the amount of fever; (3) sensitiveness of the pelvic organs to pressure; (4) disturbed involution; (5) persistent diminution in the amount of the lochia. When the symptoms begin a few hours after labor, they are probably due to infection before or during labor. If no symptoms appear by the end of the fifth day, the patient may usually be regarded as out of danger from sepsis. There are exceptions to this rule, however, as will presently be noted. The student should remember that while in the majority of cases the infection starts from the vagina or cervix, the symptoms first noticed are usually those of an endometritis.

1. **Purely Local and General Conditions.**—Extension of an aseptic thrombus from the uterine to the pelvic veins, producing the so-called benign form of milk-leg, may be mentioned as an uncomplicated local affection. The so-called cryptogenous sepsis without evidence of local lesion represents an uncomplicated general state. Simple hyperthermia, from neurotic or reflex conditions, may occur without evidences of local or general conditions. Mild sapremia or toxemia (bacterial) may accompany an ordinary puerperium (so-called resorption or "one-day" fever).

2. **Marked sapremia** occurs as a result of much putrescible material in the uterus—as in lochiometria, putrefaction of retained or adherent placenta, putrid abortion, missed labor with fetal putrefaction, gangrene of uterus, etc. Whenever it is possible to empty the uterus in time the severe symptoms usually subside.

3. **Marked bacterial toxemia** (without sepsis), corresponding to ordinary surgical fever, occurs whenever pyogenic bacteria attack the birth-tract, parametria, tubes, pelvic peritoneum, etc. As a rule, the degree of toxemia varies with the amount of pus-formation. Bacteria may reach the blood in small numbers and yet sepsis need not result. As long as the suppurative focus is surrounded by a barrier of granulation tissue, sepsis is prevented and toxemia held in check. If general peritonitis develops the toxemia is sufficient to cause death (malignant toxemia).

4. **Simple septicemia, pyemia, sapremic sepsis,** are conditions in which bacteria enter the blood in large numbers along with toxins; yet the majority of these conditions is not due so much to the bacteria as to the degree of toxemia, which is naturally much greater when the insufficiency of the leucocyte barrier allows a wholesale absorption. Hence, sepsis without metastases is practically a malignant toxemia.

5. **Metastatic septicemia and pyemia** represent not only states of intense toxemia, but the occurrence of metastatic deposits in vital organs gives these conditions a hopeless character. In septicemia proper, metastases are the results of septic endocarditis; while in pyemia, which results from metrophlebitis, metastases to the various viscera occur without the intermediation of the cardiac lesion.

At the present moment, the belief that the syncytial cells of the placenta

play a principal rôle in the toxemia of pregnancy, appears to be gaining ground, although there is much diversity as to the manner in which the results are produced. From one point of view these cells cause embolism in the liver and kidneys, thereby setting up the characteristic lesions of these organs. From another point, the cells are believed to secrete a poisonous substance which attacks the predisposed organs. These views are not incompatible with the theory of hepatic toxemia.

TREATMENT OF PUERPERAL INFECTION.

1. PREVENTIVE TREATMENT.

This has been largely discussed in connection with the management of labor, and it cannot too often be repeated that when the management of normal labor is regarded as very largely identical with the preventive treatment of puerperal infection, the latter will be of the rarest occurrence. I sum up the preventive treatment of puerperal sepsis under four heads: (1) General hygienic measures. (2) Asepsis of patient, physician, and accessories. (3) Limitation of internal examinations and manipulations. (4) Antistreptococcic serum.

(1) **Hygienic Measures.**—Under this head is to be considered everything which tends to fortify the system against disease in general. Good blood is the best of germicides, hence the importance of good hygiene during pregnancy; an out-of-door life, good diet, freedom as far as possible from sources of worry and care. The correction of anemia by iron and other tonics, the treatment of any constitutional dyscrasia, should be carefully attended to in order to prepare the patient against the inroads of septic infection. Under the same heading come certain precautions already discussed elsewhere; *e. g.*, the selection of a sunny and commodious lying-in chamber, as far as possible removed from toilets, sinks, and plumbing, and securing good ventilation. All these precautions should be regarded as important because they prepare the patient to resist infecting agents; but it should not be forgotten that all the agents thus combated do not of themselves act as the immediate causes of infection. Nor should the physician forget, in his attention to such details, that the actual cause of puerperal infection is contact of wounds in the birth canal with an infected agent.

(2) **Asepsis of Patient, Physician, and Accessories.**—*The patient* (see Management of Labor, page 472): The arrangement of the vulval pads and the subsequent cleaning of the external genitals have already been described in connection with the management of the puerperium (page 688). *The physician:* A physician who is dressing suppurating wounds, attending cases of erysipelas, scarlet fever, diphtheria, or other cases of infectious or contagious diseases, should not attend obstetric cases if he can help it. If he is obliged to do so, he should take a full bath, change his clothing, disinfect his hands and arms with special care, and make no internal examinations that are not imperatively necessary, and then only with his hands encased in sterile rubber gloves. The method of hand disinfection has been described (page 150). It is needless to say that any man who practises obstetrics should himself be free from infectious or contagious diseases; he should be cleanly as to his habits, should bathe frequently, should wear clean clothing, should keep his nails trimmed short and carefully cleaned, and should be particular even to fastidiousness about the care of his hands. The use of a sterile operating gown or duck suit and of sterile rubber gloves is an additional safeguard (page 151). *The nurse:* As

already stated, she should be free from any contagious or infectious disease, especially suppurative coryza or skin disease, nor should she recently have attended a case of infectious or contagious disease. She should also have had a full bath and change of clothing, paying special attention to the hair, which should be well washed with soap and water, then with plain water, and then with a bichloride solution (1 : 10,000). She should be expressly forbidden to give douches or practise any internal manipulations while cleansing the external genitals. *Instruments and water used:* All instruments or other appliances which are to come in contact with any part of the parturient tract should first be thoroughly scrubbed with green soap and water, especial attention being paid to any cracks or crevices, and then boiled for not less than twenty minutes. They should then be removed by an aseptic instrument and kept in a solution of carbolic acid or lysol until needed, or, better, used directly from the boiler or sterilizer. All instruments which cannot thus be sterilized should be avoided. Catheters and douche tubes should be of glass or metal, preferably glass. If it becomes necessary to use a Barnes bag, a gum catheter, or similar appliance, it should first be thoroughly washed with green soap and water and then sterilized by boiling or by steam under pressure. All water used for immersing instruments, washing the external genitals, and giving douches should first be boiled.

(3) **Limitation of Internal Examinations.**—This is perhaps the most important precaution of all, as has been fully stated in connection with the management of normal labor (page 476). It is of special importance if the physician has recently been in attendance upon any case of infectious or contagious disease, or if his hands have been contaminated by septic discharges of any kind, and in all cases during and after the third stage of labor, even if sterile rubber gloves are used.

It is, of course, true that in many cases it is impossible to carry out all of the above rules in practice. Skilled nursing and sterile accessories are not always available. But if the physician will but remember that septic contact is the one source of infection, if he insists upon and personally supervises cleanliness and antisepsis of the external genitals and their immediate surroundings, and avoids all unnecessary interference, especially after delivery, very satisfactory results may be secured even among most unfavorable surroundings.

(4) **Antistreptococcic Serum.**—The preventive power of Marmorek's serum was tested by Wallich upon 383 women who bade fair to have a septic puerperium either by reason of certain acts of exposure or accidents of delivery. Despite the precaution, 56 developed phenomena of infection. Streptococci have been more successfully combated without than with the aid of the serum.

2. CURATIVE TREATMENT.

The non-surgical treatment of puerperal infection comprises, at the present day, supporting measures, antipyretics, and various specifics and quasi-specific remedies of more or less doubtful utility, such as Marmorek's serum and Credé's silver ointment.

(1) **Supporting Measures.**—These differ in nowise from the same class of remedies employed in the treatment of typhoid fever, pneumonia, etc. The patient receives whisky or brandy according to the state of the pulse, with strychnin, $\frac{1}{30}$ grain, every three or four hours, and digitalis as necessary. Quinin is much less used than formerly, although individual authorities continue to prescribe it. Diarrhea should not be checked, and many authorities even advocate the routine use of aperients in puerperal infection, especially calomel and laxative salts. Vomiting requires cracked ice and champagne. In order

that the patient's vitality may be kept at the highest point, it is necessary that she should receive a plentiful supply of nutritious food. Milk, koumyss, broths, eggs beaten up with milk or broths, beef-juice, panopeptone, beef peptonoids, and so on, should be administered in as large quantities as the patient can assimilate. It is well, also, to try the effect of solid food—*e. g.*, raw oysters, meat, etc. In prolonged cases it is of great importance to a patient suffering from sepsis that the stomach should be in such condition as to retain an abundant supply of nutritious food and stimulants, which is a cogent reason for not giving medicines whose utility is doubtful and which may derange that organ. Good results are obtained from the subcutaneous injection of salt solution in large quantities. A more direct method, of course, is that of venous infusion. From one to two pints may be injected. (See Part X.) Washing out the colon by means of decinormal salt solution is worthy of further trial, not only upon theoretical grounds, but because occasional favorable results have been reported in puerperal as well as non-puerperal forms of sepsis. Finally, a very valuable remedy in these cases is oxygen, which should be inhaled in large quantities and systematically. The use of ergot to promote involution, and by causing uterine contraction to prevent the transmission of infection through the lymphatics, has already been mentioned and constitutes a rational method of treatment. I am inclined to believe that it prevents also the absorption of pathogenic germs which may be present in the vagina. The absorbent power of a lax uterus is very marked.

(2) **Antipyretics.**—Quinin, phenacetin, and other antipyretics have been advocated by various observers. In a process like acute peritonitis, which runs a rapid course and in which death is due to other causes than fever, they are of little or no service, and may do harm by causing cardiac depression and disturbing the stomach. In prolonged cases—*i. e.*, in pyemia—they are sometimes beneficial, and when fever is attended by headache they may afford relief. Under such circumstances they should be given tentatively if bad effects on the heart and stomach are not noticed. If the *coal-tar derivatives* are given, those least depressing to the heart should be selected, and it is well to give a stimulant at the same time. Hydrotherapy offers a better means of reducing fever in these cases. There is considerable testimony as to the efficacy of the *cold bath*, and if it is not, as occasionally happens, too depressing to the patient, its use is to be advised. My practice is to rely mainly upon the wet pack, cold sponging, and the abdominal coil as antipyretics. For local inflammatory tenderness, whether from endometritis, affections of the parametrium, or general peritonitis, the intermittent application of cold, as the *coil or ice-bag*, applied to the fundus, is usually a wise precaution.

(3) **Specific Medication.**—*Antistreptococcic serum:* Orrhotherapy in puerperal fever is still on trial. While many have abandoned it, others continue to employ it. It is necessary to exhibit the remedy in large doses. The initial injection should be 0.7 oz. (20 c.c.), while the total daily dose should be 2.1 oz. (60 c.c.) in desperate cases. In one class of cases prompt and permanent recovery appears to follow the treatment, while in others improvement is either wanting or may be only temporary. The use of this serum is, of course, irrational without evidence that the streptococcus is present in pure culture. In communities where bacteriological tests of the lochia cannot be obtained the serum may be used in any desperate case as a last resort. *Credé's ointment:* This preparation of silver, which was introduced in 1895, as a general remedy for sepsis, has been used to a limited extent in puerperal infection. As apparently hopeless cases of the latter may suddenly take a turn for the better,

a few seemingly successful tests of a remedy prove nothing. On account of the desperate nature of the disease, however, the remedy may be tried, because it is harmless and can be exhibited by simple inunction. From 15 to 45 grains (2 to 3 gm.) at a time should be rubbed into the internal aspect of the thighs once or twice daily. The duration of the inunction should be twenty minutes and the site should be afterward covered with rubber tissue.* *Nuclein. Intravenous injections of silver salts.* Nuclein has been proposed to produce an artificial leucocytosis. From a limited experience I have failed to obtain any marked results. I am compelled to make the same statement regarding the intravenous injection of the silver salts. *Mercurial ointment:* This is still employed in some European clinics, the drug being pushed to the point of salivation. By most authorities, however, this method is justly ignored. *Abscess of fixation:* This method of treatment, which is evidently the same in principle as that of the seton and issue formerly used, has been tried in a few cases of puerperal sepsis with apparent benefit. Professor Fochier, of Lyons, who is the advocate of this mode of treatment, states that in certain cases of general infection we see the patient's condition improve suddenly and materially after the development of a localized suppuration. This he terms "fixation abscess." In cases of grave sepsis he attempts the production of an artificial abscess by injecting turpentine under the skin. If no pus forms, the prognosis is hopeless. If a large abscess can be formed and allowed to increase at will without opening, the patient undergoes a change for the better. *Intravenous infusion of formaldehyde solutions:* On January 13, 1903, Barrows, of New York, reported to the New York Obstetrical Society the cure of a severe case of puerperal sepsis, by the infusion of a 0.02 per cent. solution of formalin or 0.008 per cent. solution of formaldehyde gas into a vein of the arm. The remedy has since been used with varied results by many. Further experience is necessary to prove its usefulness. *Pryor's Iodine Treatment:* An investigation of the uterine discharges and the contents of the pelvic cavity in cases of puerperal sepsis has resulted in a more definite idea of the conditions which must be treated. W. R. Pryor † has operated upon thirty-seven cases, in all but one of which streptococci, generally mixed with other germs, have been found in the uterine discharge and in all the cases streptococci were found in the pelvic cavity. He not only does a curettage in these cases and packs the cavity with iodoform gauze, but he also does a posterior section of the vagina and packs the cul-de-sac full of iodoform gauze. The results have been uniformly good, and on the third day the germs have in every case been absent from the discharges. This excellent result is attributed to the local iodism which is caused by the action of the exudates upon the iodoform, thus setting iodine free. The absorption of this iodine through the infected lymphatics is supposed to have a decided and beneficial effect. The after-treatment of these cases is so technical and consumes so much time that it would be difficult to secure for it a very general adoption. Attempts are now being made to secure this local and general iodism by more easily effected means. *Ichthyol Treatment:* I have found ichthyol apparently of value in cases in which after clearing the uterus of débris, and irrigating, the symptoms still persisted, without any marked symptoms of extra-genital infection. After the final irrigation of the uterus with a saline solution, the cavity is packed with gauze soaked in a sterile

* Unguentum Credé, containing 15 per cent. of collargolum, can be obtained in suitable half-ounce jars from Messrs. Schering and Glatz, 58 Maiden Lane, New York. Care must be taken that an inert preparation is not used.

† "N. Y. Med. Jour.," Aug. 22, 1903

solution of ichthyol in water (1 to 1). It has also been proposed to inject renewal drams of a 50 per cent. solution of ichthyol in water into the uterine cavity. With this latter method I have had no experience. I usually have the ichthyol gauze in the uterus for twenty-four hours, remove it, irrigate with a saline solution and repack. In certain cases to avoid too much disturbance of the patient I have left the gauze in the uterus for from forty-eight to seventy-two hours. The uterus should not be tightly packed.

(4) **Endometritis.**—For various reasons, and especially because nearly every case of endometritis may be regarded as containing the possibilities of a mixed infection, it is better to consider the treatment of all the forms of endometritis under a single head. The best authorities are now inclined to conservatism as regards the local treatment of puerperal endometritis, the weight of evidence tending to the conclusion that active intrauterine treatment indiscriminately applied, in the presence of streptococcic endometritis, as proved by a bacteriological examination of the uterine secretion, does much more harm than good, and my experience has led me to coincide with this conclusion. I hold the opinion that it is neither necessary nor advisable to invade the uterine cavity in every mild case of endometritis; such cases are best treated by rest in bed, the application of an ice-bag over the uterus, the administration of ergot and vaginal irrigations, the last only when the lochia are foul. The local application of cold tends to promote uterine contraction and perhaps helps to inhibit the growth of bacteria, while the administration of ergot, as elsewhere noted, aids in promoting contraction and in furthering the processes of involution by closing the lymphatics of the uterine wall. Vaginal irrigation, if carefully given (Part X), is harmless and probably beneficial. A 2 or 3 per cent. solution of carbolic acid, or 0.5 or 1 per cent. solution of lysol, or a 25 to 50 per cent. solution of hydrogen peroxide may be injected every four to six hours. When, however, the symptoms are of a more severe type, especially if they begin to appear soon after labor, in all cases in which placental retention exists or is strongly suspected, the interior of the uterus should be digitally examined (Part X). If placental or other debris, such as clots or pieces of membrane, is found, it should be digitally removed and the uterus irrigated (Part X). The digital examination of the puerperal uterus, the removal of the placenta, and the method of giving the intrauterine douche are described in connection with **obstetric operations** (Part X). The mere retention of membranes in the absence of symptoms of infection is not a justification for invading the uterine cavity after delivery, nor should any violence be done to the uterine wall in the effort to remove them, even if symptoms are present. In either case the remedy is more dangerous than the condition. On the other hand, if the interior of the uterus is smooth it may be irrigated, but further manual or instrumental interference can do nothing but harm. It is possible that these injections act simply by emptying the uterus of septic contents, and that sterile water would serve as well as disinfectant solutions. Of the latter, perhaps a 50 per cent. solution of alcohol is well worth trial, as much as one and a half to two quarts being used. If no benefit is observed, the injection may be repeated in twelve hours; but if improvement does not follow the second injection, little benefit is likely to be derived from further intrauterine treatment. Should the injections appear to cause improvement, they may be cautiously repeated from time to time, according to results. Should no benefit be observed, it is unwise to continue them, as they are by no means free from danger. A careful bimanual examination should be made in each case, and in those cases in which the parametrium is involved, intrauterine injections should not be given, but vaginal

injections may be employed. Antiseptics may be introduced into the uterine cavity in the form of suppositories or on gauze. The use of the iodoform pencil is strongly advised by some, while others advocate the use of iodoform gauze. I have abandoned the use of both. Carossa fills the uterus with gauze which he saturates at hourly intervals with 25 to 50 per cent. alcohol. Among other substances which may be introduced by the tampon are chlorine water, tincture of iodine, and especially the colloidal silver of Credé (see page 751). In the past the curette has played an important part in the treatment of puerperal endometritis, but the best authorities have now reached the conclusion that its use, while often productive of the greatest good in the treatment of sepsis following abortion, does far more harm than good in the treatment of sepsis at full term. The objections to its use may be stated as follows: (1) It is difficult to go thoroughly over the whole surface of the uterus; (2) the puerperal septic uterus is soft and easily perforated; this accident has happened to experienced operators; (3) whatever is necessary can usually be done more intelligently and thoroughly by the finger; (4) last and most important, curetting destroys the barrier which nature has established against the progress of infection, and which has been discussed in connection with the pathology of puerperal septic endometritis (page 719, Fig. 940). Moreover, experience has shown that good results have been obtained by methods similar to those which I have described. Krönig obtained, by expectant and supporting measures, a mortality of 4 per cent., and in all his cases the presence of the streptococcus was demonstrated in the lochia. It is doubtless true that in certain cases of fever following delivery there is prompt subsidence of symptoms after curettage. Such cases, however, are cases of sapremia which almost always terminate favorably, either spontaneously or under treatment. If streptococci as well as saprophytes happen to be present, curettage may result in the extension of the infectious process and in serious and even fatal accidents.

Résumé.—To sum up the treatment of puerperal endometritis: (1) retained placenta should, when possible, be removed digitally; (2) mild cases should be treated expectantly by the use of the ice-bag, ergot, etc., vaginal douches being used if the lochia are offensive; (3) in severe cases the uterine interior should be carefully examined digitally, and when practicable, bacteriologically; debris should be manually or instrumentally removed; the uterus carefully irrigated and the irrigation repeated if necessary within twelve hours, preferably with a 50 per cent. solution of alcohol. This treatment to be commenced as early as possible. If intrauterine treatment is not beneficial, it should be discontinued and every precaution taken to prevent injury to the soft parts of the mother during manipulations.

(5) Mastitis.—(See page 765.)

(6) Pyogenic Urethritis, Cystitis, Pyelitis.—If infection has already occurred, as shown by the onset of cystitis, the bladder should be washed out every four hours with a weak solution of boric acid. This is best done by means of a silver return catheter and fountain syringe, the bladder having been emptied. The reservoir should have but a slight elevation above the bladder. No air should be admitted. As soon as the patient feels the sense of fulness in her bladder, she should be allowed to empty it. Urotropin should be given inwardly. If the upper part of the urinary tract becomes infected, the resulting case is one for operative surgery. Puerperal gonorrheic urethritis is mentioned elsewhere. (Fig. 950.)

(7) Puerperal Salpingitis.—The treatment is that for localized suppuration elsewhere. If the diagnosis is made early an ice-bag may be applied. After

pus has collected it must be evacuated, it being understood that the primary focus in the uterus has been properly treated. The conservative vaginal incision should be employed to reach the pus. Gonorrheal puerperal salpingitis will be mentioned elsewhere; likewise salpingitis secondary to septic peritonitis.

(8) **Metritis.**—We must reiterate that puerperal metritis is not a clinical entity. The moment the leucocyte barrier is overcome, or the thrombi in the uterine sinuses are attacked, the infection is already to be considered as having extended beyond the uterus. This is best shown clinically by the fact that no indications for hysterectomy for puerperal sepsis can be laid down save in exceptional cases like an adherent placenta, an infected myoma, etc., in which the operation is really prophylactic.

(9) **Parametritis.**—The management of a parametritis, whether essential or a complication, is that of an impending or actual abscess-formation in general. At the outset an ice-bag is applied and opiates given, both rendering especial service in warding off suppuration and peritonitis. The patient must also be kept immobilized to the greatest possible extent. This management, when put in force at an early period, justifies a good prognosis. If suppuration is under way warm compresses about the abdomen may hasten it. Pus should be evacuated by the posterior vaginal incision. In order to hasten resolution, both in abortive cases and after suppuration, the patient should be placed on her back with elevated hips, and the posterior cul-de-sac irrigated twice daily with several quarts of hot water.

Oöphoritis may be regarded practically as a parametritis; it is caused usually by lymphatic extension from the endometrium.

(10) **Perimetritis.**—Perimetritis and parametritis require precisely the same management, viz., absolute rest, the ice-bag, and opiates; so that a differential diagnosis during the early days is not a matter of supreme importance. Rest must be so absolute that no attempts at irrigating the birth tract are permissible, even if the lochia are foul and purulent. The surgical treatment is along the lines of parametritis and will be discussed more fully in the general section.

(11) **General Peritonitis.**—In the absence of general sepsis, there is an opportunity of accomplishing something by *treatment* directed to the peritoneum. In the very earliest stages an attempt should be made to limit the process by ice and opiates. After meteorism has fully developed it is of course useless to expect anything from abortive treatment. In theory, prompt laparotomy with evacuation of all the contents of the peritoneal cavity—bacteria, exudate, etc.—is indicated; but only in a very few cases is this heroic resource efficacious. The most promising cases are those in which a sudden escape of pus, etc., has inoculated the entire peritoneum, such as occurs in rupture of an abscess. The surgical treatment of general peritonitis will be discussed more fully later (page 756). In the absence of surgical intervention, palliative treatment may give some relief. The inflated abdomen may be subjected to warm packs; tympanites may be relieved by means of a long colonic tube. Stimulants of all kinds and appropriate nutriment are indicated. Fortunately, as already stated, the end of these patients is often peaceful.

(12) **Metrophlebitis or Septicæmia Venosa.**—There is practically but a single indication in this affection—the prevention of metastasis. This is best fulfilled by absolute rest in bed. The least effort, as in having the bedding changed, may bring on a chill. It may happen at times that the loosening of the thrombi as a result of their suppuration is attended by hemorrhage (secondary post-partum hemorrhage). The uterus and vagina in these cases must be tamponed, and ergot should be given in large doses. If the tampons do not arrest the hemor-

rhage, intrauterine injections of hot acetic-acid solution, 2 to 6 per cent., may be used with vaporization as a last resort.

(13) **Phlegmasia Alba Dolens.**—The patient should be kept perfectly quiet in bed and all manipulations should be avoided in order to prevent embolism. The leg should be elevated and wrapped in cotton. A nutritious diet is indicated, but over-stimulation should be avoided on account of the danger of embolism. The patient should remain in bed for two weeks after the subsidence of the swelling. The resulting œdema is best treated by the application of a bandage. In the cellulitic form abscesses are likely to develop in the femoral region, and should be opened as soon as practicable in order to avoid the fistulæ which are apt to occur.

Many local remedies are advised for this condition. Among them are: painting along the course of the swollen veins, once daily or upon alternate days, with tincture of iodine; wrapping the limb in 2 per cent. carbolic acid solution or a solution of hamamelis; the local application of the ointments of belladonna and mercury either alone or in combination; and the use of various strengths of ichthyol in aqueous solution. Of these, I have found a 25 to 50 per cent. ichthyol solution to give the best results. In some cases I have used it even undiluted.

3. SURGICAL TREATMENT.

(1) **Curettage.**—This resource, used by many in a routine fashion, is regarded by others as a dangerous practice. We sometimes see the temperature rise and the disease take a fatal turn after this operation. During an interval of ten years Bumm * has seen in his own practice ten untoward results of curettage: 5 cases of phlegmasia alba dolens, 3 of fatal pyemia, and 2 of fatal peritonitis. The endometrium should never be curetted in streptococcic infection; in the first place, 80 per cent. of these patients recover spontaneously from the formation of a protective layer of leucocytes in the decidual lining of the uterus. The germs leave the uterus in connection with the necrosis and expulsion of the decidua; the use of the curette is therefore distinctly meddlesome. It breaks down the defensive wall and allows the streptococci to penetrate into the uterus and gain the peritoneum; this being the method by which curettage may set up peritonitis. Less virulent streptococci may attack the exposed placental site and enter the venous sinuses, there causing purulent disintegration of thrombi or perhaps an endophlebitis of the crural vein with resulting phlegmasia alba dolens. Curettage, in fact, is indicated only in putrefaction of decidual and placental remains with resulting sapremia. Here the results are very satisfactory because these saprophytes can exist only on dead tissue. Even here, however, the fingers should be used to remove all large masses and the placental site should never be curetted.

(2) **Vaginal Incision and Drainage.** (Figs. 962 and 963.)—Incision through Douglas's pouch in acute pelvic suppuration of puerperal origin necessarily presupposes an accurate diagnosis which can be made only by bimanual examination under narcosis. Krönig warns against the employment of this resource lest a recent adhesion be ruptured with subsequent development of diffuse peritonitis. As there is no certainty that vaginal incision will lead to evacuation of the pus, the operator, according to Krönig, would best pursue the expectant plan. Quite recently certain operators have advocated vaginal incision and drainage in acute pelvic peritonitis and cellulitis.† A parallel instituted between this procedure and the expectant management apparently shows the superiority of the former.

* "Ueber die chirurgische Behandlung des Kindbettfiebers," Halle, 1902.

† "American Journal of Obstetrics," Mar., 1902.

The majority of authors do not even mention early vaginal incision in this connection. The ultimate removal of pus by incision through the Douglas pouch, after due waiting for resorption to occur, is permissible if the pus is walled off and the patient in good condition.

(3) **Extirpation of the Infected Uterus and Laparotomy.**—This is indicated in cases which do not improve after evacuation of the uterus, providing the disease is still confined to the latter. Schultze performed this operation successfully for retained placenta, Stahl for suppuration of a myoma in the puerperium, Sippel in putrid endometritis, Prochownik in septic abortion, etc. Many of these hysterectomies have been performed in America. Bumm * has performed five extirpations of the uterus with two recoveries. The fatal cases were all examples of streptococcic infection. The indications for this operation are difficult to determine. If one waits for the infection to reach the confines of the uterus, as shown by local symptoms in the immediate neighborhood

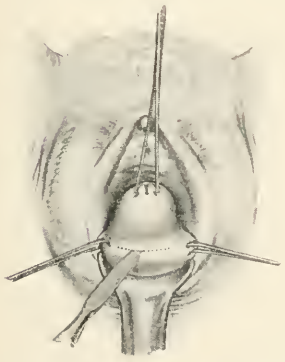


FIG. 962.—VAGINAL INCISION AND DRAINAGE. Shows the incision being made through the posterior utero-vaginal junction into Douglas' cul-de-sac.

FIG. 963.—VAGINAL INCISION AND DRAINAGE. Gauze and rubber drainage-tube introduced through the vaginal incision.

of the latter, operation as a rule will result in stump infection and subsequent peritonitis. On the other hand, there is a natural hesitancy in regard to performing hysterectomy in incipient cases, because spontaneous recovery is likely to follow any type of infection. The infectious germs may be propagated in all directions—into the tubes, veins and lymphatics, and upon the peritoneum. Cases of this type are inoperable. Something can be done toward the diagnosis of operability by anesthetizing the patient and a thorough bimanual palpation of the tubes, ovaries, and pelvic connective tissue. To perform laparotomy as a last resort, in default of precise indications, is not justifiable, although now and then a cure may be accomplished. If a puerperal pyosalpinx develops, the germ is usually the streptococcus which maintains its virulence unchanged. The danger of infecting the peritoneal cavity in attempting to remove a pyosalpinx is very great. Miliary abscesses and detached colonies

* *Vide supra.*

of germs may be present in the inflammatory zone which surrounds the tumor. Premature intervention in pyosalpinx is strictly contraindicated, for it may be that the septic process is about to become localized. In regard to septic peritonitis, all our resources—simple incisions, irrigation, and drainage—notably fail when a large amount of peritoneal surface is involved. Bumm * cites a case in which he made a free incision in the linea alba, took out a portion of the intestine, removed all exudate, irrigated the abdominal cavity with many quarts of saline solution, tamponed the pelvic cavity with iodoform gauze, and finally made counteropenings to secure abundant drainage. These patients usually perish rapidly from collapse; enormous numbers of streptococci are found post mortem upon the peritoneum of all the abdominal organs. To combat peritonitis successfully, laparotomy would have to be performed as soon as the disease begins, with removal of the infected uterus at the same time. This intervention is too severe for most patients to undergo. The only recoveries common in puerperal peritonitis occur in cases of encapsulated collections of pus. Pelvic abscess is in itself a favorable termination for puerperal sepsis, because it indicates arrest of the infective process. There is little danger that the pus will burrow, and incision is indicated only when the original small purulent foci have coalesced to form a large abscess. Puncture is more practicable than incision in these cases. If the abscess is opened at the abdominal wall, a counteropening should be made in the vagina, and vice versa.

(4) **Excision of Veins.**—The question of the excision of veins as preventive of pyemia naturally arises. Autopsies frequently show veins plugged with purulent thrombi which were amenable to excision, the lesion being limited to a small portion of a single vein; for example, one of the spermatics. Physical exploration under deep narcosis will sometimes enable the operator to feel the infundibular ligament of the pelvis as a thick, indurated cord. The technique required for the excision of these veins is not difficult. Bumm has operated three times, but unfortunately without success. In one case a septic phlegmon was found in association with the thrombo-phlebitis; in a second, which promised well, the left spermatic vein was the seat of suppuration. It was resected within wide limits and the pyemic chills ceased within three days. The patient succumbed, however, from a fresh purulent focus in the same vein. In the third case, as in the first, the phlebitis was accompanied by an extravascular phlegmon. Trendelenburg succeeded in saving a patient by this operation in 1902.* This form of intervention appears to be justifiable as a last resort.

(5) **Atmocausis.**—Sneguireff's method of vaporization has been suggested by Dührssen † for septic or putrid endometritis. As this form of intervention must necessarily produce obliteration of the uterine cavity with consecutive atrophy of the organ, it could be employed only in women near the climacteric, and even then solely as a last resort. The technique is very simple. A boiler heated by alcohol has a metallic supply tube attached which is introduced into the uterine cavity through a fenestrated catheter which is surrounded in turn by another tube of non-conducting material for the protection of the cervix. The contact of the steam with the uterine cavity should not exceed one and a half to two minutes. The pain is insignificant, so that no anesthetic is required. I have had no experience with this method.

* *Vide supra.*

VIII. ANOMALIES OF THE BREASTS.

1. Absence of Mammæ, or Amazia.—This anomaly is extremely rare. It has been said that absence of one breast occurs only in women, and absence of both only in monsters who are otherwise extremely deformed. A stunted condition of the breasts is often associated with imperfect development of the true sexual organs.

2. Hypertrophy.—This anomaly is also rare, and generally occurs in those quite young. One breast is often larger than the other. Lactation sometimes diminishes the size of the hypertrophied breasts.

3. Lactation Atrophy of the Breast.—A phenomenon well known to the laity, but seldom or never alluded to in textbooks on obstetrics, is frequent dwindling away of the mammary fat after lactation. That the gland itself is not involved is shown by the restoration of the original bust after a new conception, subject, of course, to the changes incidental to multiparity. The cause of this atrophy appears to have nothing specific in its character, but it is one of the greatest sources of anxiety to modern woman, as shown by the number of expedients in vogue to overcome or conceal it. Theoretically, it is possible to produce mammary hypertrophy by massage and inunctions of fats. Clinically, the results are most disappointing.

The same is true of the use of goat's rue and other drugs. A relatively small amount of paraffin injected into the breast will produce the desired effect; I have had no personal experience in the matter, but know of accidents from its use.

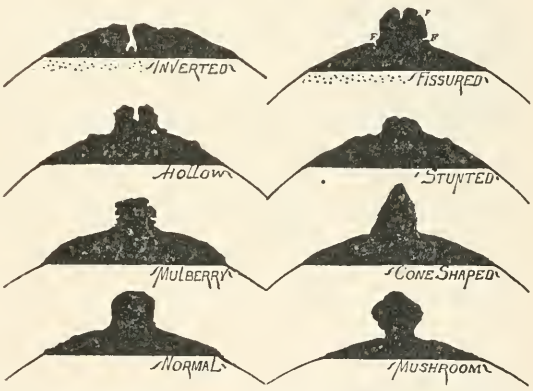


FIG. 964.—COMPARISON OF FAULTY AND NORMAL DEVELOPMENT OF THE NIPPLES.

4. Supernumerary Breasts: Polymazia or Polymastia.—This condition is rare. These extra mammæ are generally found on the chest below the normal gland and more median in situation. However, instances are on record of their being found in the most varied situations. This fact does not admit the theory of reversion. Men seem to exhibit this phenomenon as frequently as women, if not more so. Heredity seems to account for it in some instances. Supernumerary breasts vary in size from a minute collection of glandular tissue to a full-sized breast secreting the normal amount of milk (Fig. 336).

5. Anatomical Anomalies of the Nipples (Fig. 964).—(1) *Congenital absence* (*athelia*): This condition rarely occurs. When acquired, it is generally due to injury, or it may result from suppuration of the infantile breast. (2) *Flat and inverted nipples* (*microthelia*): This anomaly may be either congenital or acquired and is common as the result of corset pressure. It should be recognized at the examination of pregnancy (Fig. 964). The treatment consists in drawing out the nipple with the fingers or breast-pump in the latter part of gestation. Breast-shields may obviate the difficulty of nursing. Artificial feeding may become necessary. (3) *Fissured nipples* (Fig. 971): The nipples are exposed to

the discomfort of chafing from the continual changes of dryness and moisture to which they are subjected. Many parturient women suffer from this trouble. There is danger of the entrance of micro-organisms and of subsequent inflammation. *Treatment* is chiefly prophylactic, as elsewhere described (page 187). Exposure of the nipples to the ordinary atmosphere is excellent to harden them. Boric-acid solution as a wash is most useful. After ulceration has once been established vigorous measures are necessary.

IX. ANOMALIES OF THE MILK SECRETION.

1. **Deficient Secretion: Oligolactia or Agalactia.**—A deficiency of milk in the nursing woman is quite common, but a complete suppression is not frequent. Deficiency may be caused by a congenital or acquired defect in the structure of the mammary glands. Ill health, advanced age, or obesity may also be a cause. It sometimes occurs after a premature or still-birth, and also follows a previously abundant supply of milk, and is then often due to continuous overexertion. The milk secretion is mainly dependent upon the general condition of the mother and upon the diet. *Treatment:* If the cause is some defect in the structure of the breasts, treatment is of little avail. If, however, there are other causes, such as ill health, overwork, etc., a carefully regulated diet, change of air and scene, tonics, and other hygienic measures are often effective. Gentle massage has been followed by beneficial results. Crabs, whether hard- or soft-shelled, have been found the best milk producers among foods. Many kinds of sea food, especially shell-fish, seem to have the same influence. Boiled fresh beets, without vinegar, are one of the best vegetables.

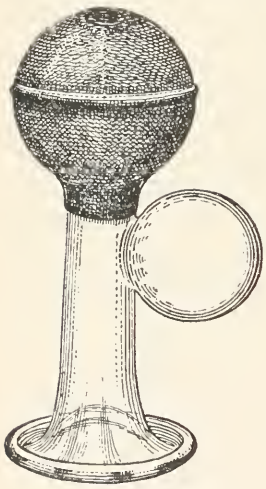


Fig 965.—Ordinary Breast-pump.

Fig. 966.—Nipple Shield.

2. **Excessive Secretion.**—(1) *Polygalactia:* This condition is one of an excessive amount of milk. Congestion and engorgement of the breast are not necessarily present. Its occurrence is not frequent. It may develop during the first part of lactation and gradually subside. If it continues, to the great discomfort of the mother, means should be taken to overcome it. *Treatment* consists in regular times of nursing, in emptying the breasts by massage, the breast-pump, or compression. The diet may be restricted and the amount of fluids diminished. Laxatives should be given. (2) *Hyperlactation:* Lactation pro-

longed beyond the ninth month may result in an exhausted physical condition of the mother, which is sometimes termed *tabes lactealis*. This habit is most prevalent in the lower walks of life. The mother may develop symptoms of anemia accompanied by neuralgic pains. Nervous manifestations often follow. The symptoms are profound anemia and pains in the upper extremities during nursing. Phthisis also may develop. The child must be weaned at once. Tonics must be administered to the mother, while a change of air will be found very beneficial. (3) *Galactorrhea:* This affection consists in a continuance of the milk secretion with constant flow between the periods of nursing. The milk is of poor quality. Both breasts are generally affected. In certain cases the quantity of milk is excessive, resulting in exhaustion of the mother. The causes are unknown. It may be a nervous affection. The almost continuous flow of milk with loss of strength and interference with nutrition brings about anemia, emaciation, and nervous disorders. The *treatment* is unsatisfactory. Iodide of potassium and ergotin are recommended; atropin locally (1 gr. to 1 oz. of glycerin) I have found of great value. Return of menstruation sometimes increases the flow. Belladonna ointment is preferred by some; I have found it less certain than atropin in glycerin or vasogen. A lotion for bathing the nipples, consisting of a 5 per cent. solution of cocaine hydrochlorate in equal parts of glycerin and water, often assists in the treatment. Saline laxatives to keep the bowels open are of benefit. Electricity is not always attended by the results hoped for.

3. Qualitative Anomalies.—The quality of the milk is also variable, depending upon many conditions. The diet of the mother is a very potential factor in influencing the quality of the milk. This should, as a rule, be about the same as she has always been accustomed to; it should comprise plain, mixed foods with a slight excess of fluids; milk taken between meals is beneficial; the intervals between nursing periods should be carefully regulated; excessive emotion of any kind is always to be avoided.

X. DISEASES OF THE BREAST.

1. Areolar Inflammation.—Inflammation and even abscess of the glands of Montgomery may occur, but may be prevented by cleanliness or treated by incision.

2. Congestion and Engorgement.—Engorgement and congestion of the breasts, "caked breasts," usually occur on the third day; the pressure and irritation being so great as sometimes to cause pyrexia. The treatment consists in securing profuse serous discharges from the intestines with saline cathartics, in the application of heat to the breasts in the shape of hot stupes under pressure, and in emptying the breasts by digital massage through hot stupes (Figs. 967, 968, 969). Saline catharsis, moist heat with pressure, and rest are the principles in the treatment of caked breasts.

3. Sore Nipples.—Simple erythema, excoriation, erosion (Fig. 970), fissures or cracks, and eczema of the nipples are all included under the term "sore nipples," and all these conditions can usually be prevented by proper attention to the nipples during pregnancy and the early puerperium. The prophylactic treatment consists in the preparation of the nipples for lactation during pregnancy. During the later months the nipples should be washed daily with soap and water and carefully massaged with sterile vaseline and alcohol. (See page 187.) The cura-

tive treatment consists in careful cleansing after each nursing with boric-acid solution; in the use of a nipple shield (Fig. 966); in the application of bismuth and castor oil, compound tincture of benzoin, oxide of zinc, or nitrate of silver.

4. **Mastitis; Mammary Lymphangitis; Galactophoritis.**—*Varieties:* Three varieties may usually be recognized: namely—(*a*) subcutaneous, (*b*) parenchymatous, (*c*) submammary (Fig. 971). Mastitis was formerly of common occurrence, but since its infectious nature has been recognized it is much less common. It occurs more frequently in primiparæ and during the second and third weeks of the puerperium, but may occur late in lactation. It is rare after the fourth pregnancy. *Etiology:* All forms of mastitis are to be regarded as forms of infection. The infecting agent is usually Staphylococcus aureus, less often the streptococcus. Staphylococcus albus is found in the secretions of healthy women in from 80 to 94 per cent. of cases, and, as a rule, is of no pathological importance to either mother or child (Olshausen and Veit). The starting point of infection is usually a fissure or an erosion of the nipple, but the milk ducts may become infected without this. Occasionally the process starts from an abrasion of the areola or skin surface of the breast. Infection by micro-organisms circulating in the blood has been assigned as a cause, but this claim has not been proved. Metastatic abscesses of the breast may, of course, occur in pyemia as the result of thrombotic infection. Inspissation of milk, caked breasts, was formerly supposed to be the cause, but this has been disproved. It is, in my opinion, a predisposing cause. The superficial varieties of mastitis are the result of lymphatic infection, while in the more deeply seated it is generally believed that the infection is transmitted through the milk ducts. Contact of the nipple or breast, especially if eroded or fissured, with unclean hands, clothes, breast-pump, etc., and, under certain conditions, with the child's mouth, are all sources of infection.

FIG. 967.—MASSAGE AND MILKING OF DISTENDED OR "CAKED" BREASTS THROUGH HOT MOIST FLANNEL. The left hand supports the breast, while the fingers of the right hand produce gentle but firm massage radiating from the base toward the nipple.

(*a*) SUBCUTANEOUS MASTITIS (Fig. 971).—This is a superficial and circumscribed inflammatory process usually located under or near the areola. It is always due to infection through the lymphatics. The gland proper is not

involved. The treatment includes, in the early stages, supporting measures and the application of a 50 per cent. ichthyol solution, and, if abscess forms, incision and evacuation of the pus, followed by an antiseptic dressing. In this form of mastitis it is not always necessary to remove the child from the breast. Care should be taken to make the incision either entirely within or entirely without the areola, since pigmentation may follow the line of incision. In very rare cases the inflammation takes on an erysipelatous type, becomes rapidly diffused, and is followed by extensive suppuration and sloughing. The axillary glands may be enlarged and tender. Accompanying the local process are grave constitutional symptoms, such as chills, high fever, and general prostration.

Inflammation of the Glands of Montgomery.—Suppuration of the glands of Montgomery within the areola sometimes occurs, and after rupture obstinate ulcers may form. The glands should be incised, the pus evacuated, and an antiseptic dressing applied. An ulcer, if present, should be treated on general surgical principles.

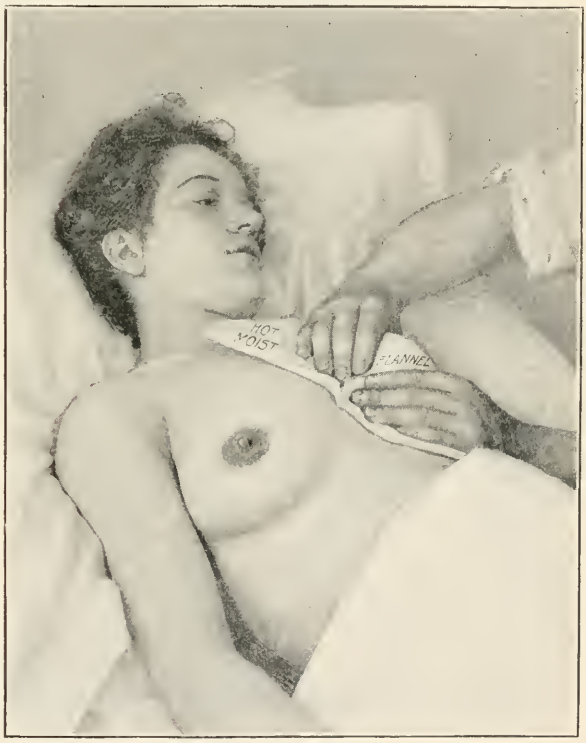


FIG. 968.—MASSAGE AND MILKING OF DISTENDED OR "CAKED" BREASTS THROUGH HOT MOIST FLANNEL. Both hands are used to jointly massage the breast and empty the milk ducts.

(*b*) PARENCHYMATOUS MASTITIS.—Inflammation of the gland proper is usually called "parenchymatous mastitis." There are, however, two distinct forms which may be clinically recognized: in one the inflammation begins in the acini (Fig. 971), and in the other it begins in the interstitial tissue (Fig. 971). When it begins in the acini, the interstitial tissue becomes secondarily involved, and vice versa. If the inflammatory process begins in the parenchyma, the symptoms are a chill or chilly sensation and a sharp rise of temperature, perhaps to 104° F. or even higher. The patient seldom complains of pain in the breast, but examination discloses a hard, localized swelling which is tender to the touch but not unbearably so; there may also be a slight redness of the skin. When the process begins in the interstitial tissue, it is also accompanied by localized swelling, which, however, is not at first well defined. This swelling gradually increases and redness of the skin soon appears. In this form of mastitis the temperature rise is gradual and a well-marked chill is not common, although chilly sensations may occur. Whenever the fever continues for thirty-six hours, it is likely that a suppuration is taking place; a rapid pulse is also considered suspicious.

FIG. 969.—MASSAGE AND MILKING OF DISTENDED OR "CAKED" BREASTS THROUGH HOT MOIST FLANNEL. After softening of the breasts by the methods shown in Figs. 967 and 968, the fingers of one hand are often sufficient to relieve the tension and empty the milk ducts by massaging from the base to the nipple.

FIG. 970.—SUPERFICIAL EROSION OF THE LEFT NIPPLE.

The *prophylactic treatment* has already been referred to and applies to all varieties of mastitis. It embraces the proper care of the breasts and nipples and of the child's mouth, and also the prompt treatment of erosions and fissures. Engorgement of the breasts and inspissation of milk should be treated by massage through hot flannel, thus softening and relieving tension by milking into the flannel (Figs. 967 to 969), by bandaging the breast in such a way as to secure firm compression (Fig. 972); and by the administration of a saline

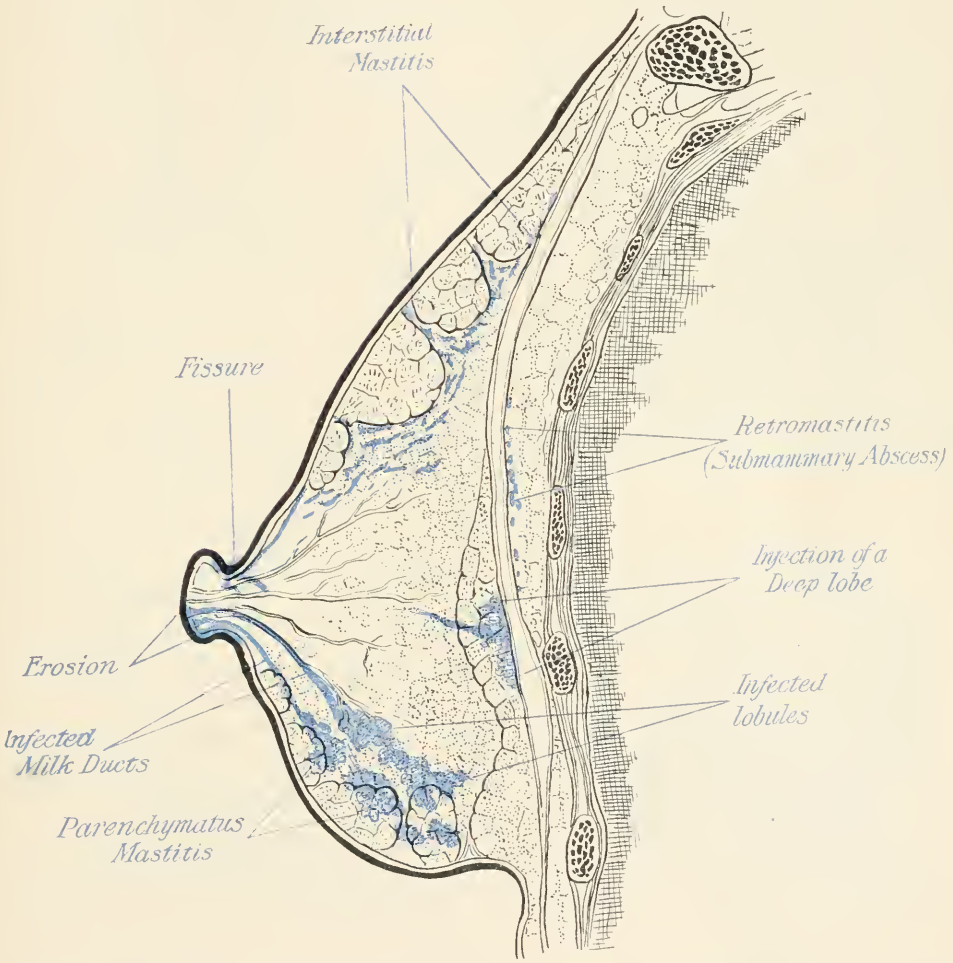


FIG. 971.—THE EXTENSION OF INFECTIVE PROCESSES IN THE BREAST. The course and site of the infection are shown in color.

cathartic. After an inflammatory process has begun, however, manipulation can only do harm.

The *curative treatment* before suppuration has occurred consists first in removing the child from the breasts, which should then be supported but not compressed. An ice-bag should then be applied over the inflamed area and relief may be afforded by compresses soaked in lead-and-opium wash and covered by oiled silk or rubber tissue. Free serous movements of the bowels should be early

secured. These measures, however, should not be allowed to delay timely surgical treatment, which should be instituted as soon as the presence of pus can be determined.

After suppuration has occurred in cases of subcutaneous abscess, local anesthesia will usually be sufficient, as by cocain or ethyl chloride. In some cases general anesthesia will be required, nitrous oxide being most desirable. The lowest point of the abscess should be located as nearly as possible and the incision should be large enough to admit the finger, and should be in a direction radiating from the nipple in order to avoid severing one of the lacteal ducts. When practicable the incision should be made in the mammary fold so as to avoid an unsightly scar of the breast. The finger should be used to remove broken-down tissue and to break up any thin partitions which may separate or only partially separate a neighboring pus cavity. One or more counter openings may be made in order to secure free drainage. The cavity is then irrigated with peroxide of hydrogen or some other mild antiseptic solution, the opening packed with gauze, and an antiseptic dressing with a moderately firm bandage is applied. In from twenty-four to thirty-six hours the gauze should be removed and the

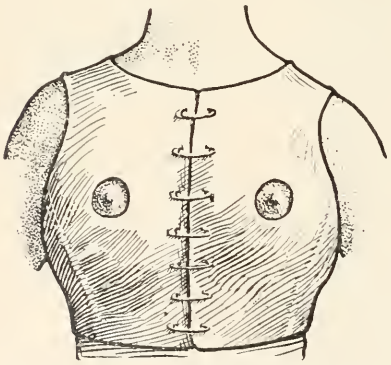


Fig. 972.—Murphy Breast-binder in Place.

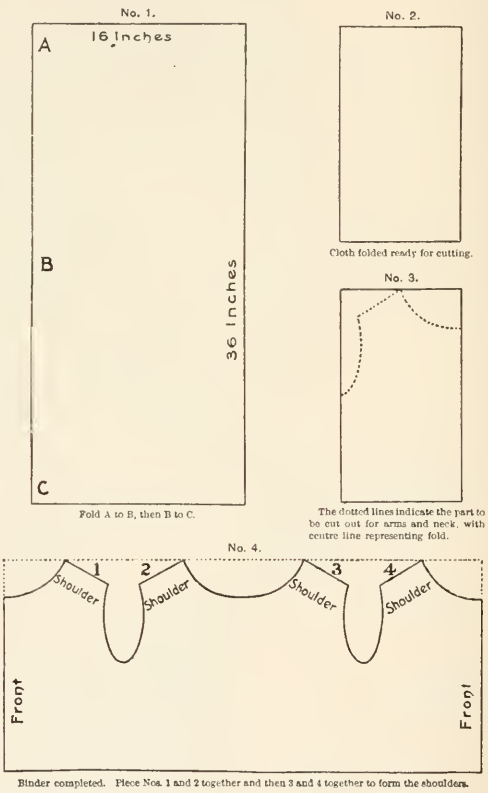
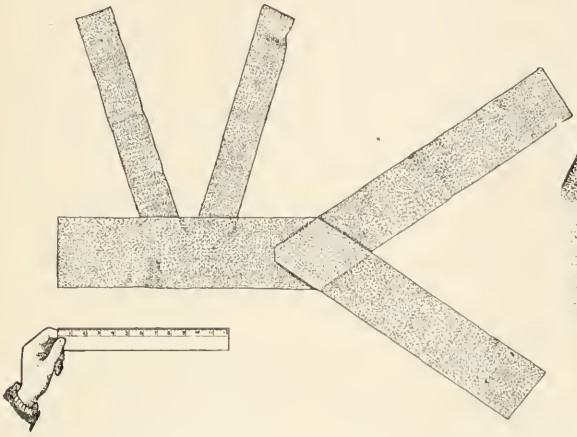


Fig. 973.—Pattern of Murphy Breast-binder Used at the New York Maternity Hospital.

openings lightly packed. As soon as the discharge becomes very slight the gauze is removed and the breast firmly compressed. If healing is not satisfactory or if the cavity remains full of thick pus, better results may perhaps be secured by the use of perforated drainage-tubes, which should not be less than one-fourth inch in diameter. The dressing is changed the following day, and after that allowed to remain for four days, when the tube or tubes should be removed and shortened one-half. It is desirable to remove the tubes within two weeks or less if possible. Their prolonged retention is likely to cause fistulæ. The aim of either method is to secure drainage while at the same time promoting the rapid closure of the cavity. As a rule, this is better accomplished by gauze than

by drainage-tubes. If the latter should be deemed best at first, it is wise to substitute a light gauze packing as soon as circumstances will permit.

(*c*) Submammary Abscess (Fig. 971).—This variety of abscess is situated under the gland and is the result of the extension of abscess formation from the gland proper. The symptoms include pain, which is deeply seated, œdematous swelling of the breast and surrounding skin with little or no redness, inability to move the arm freely, swelling of the axillary glands, and the general symp-



G. 974.—Y-Shaped Breast-binder Used at the Boston Lying-in Hospital.

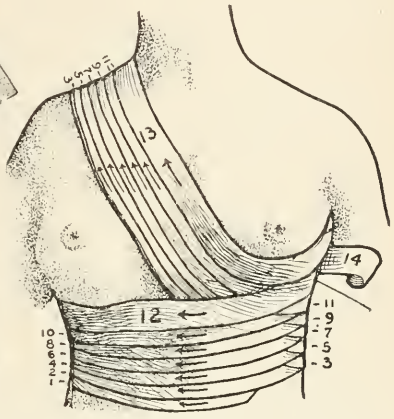


Fig. 975.—Cross Bandage of one Breast.

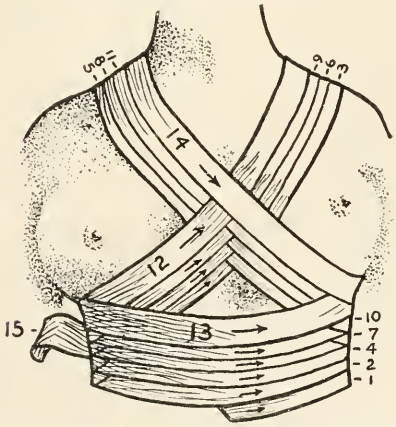


Fig. 976.—Cross Bandage of the Two Breasts.

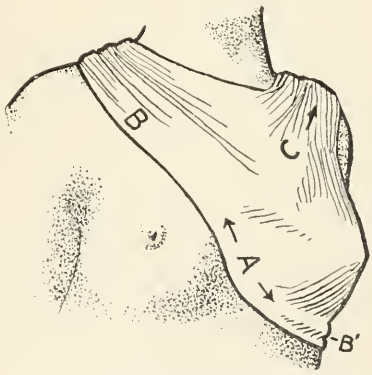


Fig. 977.—Triangle Bandage of One Breast.

toms of sepsis—chills, fever and prostration. The breast feels as though it were floating on a fluid base. If the pus is not evacuated, it may burrow in any direction, and has even been known to perforate the chest-wall and enter the pleural sac. I once saw a case in consultation in which a submammary abscess had passed unrecognized, death resulting from sepsis and pyemia, as was proved by autopsy. The presence of pus is determined by the aspirating needle, the breast being drawn upward and held while the needle is introduced along the chest-wall beneath the gland. A grooved director is then passed in and an opening made large enough to admit the finger. The further treatment,

by irrigation, drainage, etc., is the same as that already described for abscess of the gland proper. Special care should be taken to secure free communication between a submammary abscess and any abscess in the gland proper.

5. Galactocele.—Galactocele is a milk tumor due to occlusion of one or more lactiferous ducts, and is a rare condition and of little importance. Puncture of the tumor may become necessary, but heat with pressure or massage through hot stupes (Figs. 967, 968, 969) will usually suffice.

XI. BLOOD CONDITIONS.

1. Puerperal Thrombosis and Embolism.—The blood in pregnancy is peculiarly coagulable and the circulation sluggish. With these conditions only mechanical obstruction is necessary to cause the formation of a clot. This takes place in one of the venous trunks and is followed by serious consequences. The great importance attaching to thrombi is their liability to break up and form emboli. These are carried along to the smaller peripheral vessels. Puerperal thrombosis is most common after severe post-partum hemorrhage. Thrombosis of the veins is the most common cause of sudden death both in labor and in the puerperium. The femoral, pelvic, and uterine veins are the most frequent seat of this trouble. Large soft clots may be formed in the event of partial detachment of the placenta, or of imperfect contraction of the uterus followed by sudden hemorrhage which causes a weakened heart action. These clots extend from the larger sinuses toward the heart. Any sudden disturbance may dislodge bits of these masses and the blood-current will drive them on as emboli. The *symptoms* of puerperal thrombosis are very sudden. With no prodromes there occur a distressing dyspnea and air hunger. The patient suffers the throes of suffocation. Cyanosis or pallor spreads over the surface of the body, which becomes cold and clammy. The heart is rapid and irregular and the pulse small and feeble. The patient fears impending death. This may occur with a sudden convulsion. However, recovery may gradually take place from the slow absorption of the clot. A rare occurrence is the formation of clots in the arteries of puerperal women, instead of, or coincident with, the formation of clots in the veins. The symptoms will depend upon the particular organ affected. If the cerebral arteries are obstructed, then paralysis and aphasia result; if the ophthalmic, blindness follows. When the clot is in the brachial or femoral artery, the corresponding limb will grow cold with loss of sensation and motion, or it may be the seat of neuralgic pain. Pulsation is absent below the obstruction and increased above it. If the collateral circulation is not sufficient for the needs of the limb, then gangrene may occur. The *diagnosis* is usually not difficult. The *prognosis* is grave. Most of these patients die before medical aid can be summoned. The cause of death is disputed, some believing it to be cerebral anemia, others cardiac syncope, but it is probably asphyxia. For *treatment*, full doses of cardiac and respiratory stimulants should be administered. To relieve pulmonary congestion leeches should be applied. The most absolute rest and quiet must be enjoined. The diet must be liquid. Oxygen inhalations may be of benefit.

2. Hematoma.—(See Maternal Dystocia, page 613, and Puerperal Hemorrhages, page 704.)

3. Puerperal Anemia.—A tendency to anemia probably exists during pregnancy. After the child is born there is a return to the normal condition of the blood before the completion of involution of the uterus. When this change

does not occur, the woman becomes markedly anemic. The *etiology* is not clear. It may be due to a serious constitutional disorder. The patient may be possessed of slight powers of recuperation. Acute anemia caused by hemorrhage may be the forerunner. The *symptoms* are great weakness and pallor, neuralgic pains and backache. There is poor appetite. Hemorrhages are readily caused, and, as a rule, are from the mucosa. The diagnosis is made from the symptoms, physical signs, and blood examination. The *prognosis* is uncertain. The disease yields generally to prompt treatment, but if neglected it may develop into pernicious anemia. For *treatment*, strict hygienic measures must be enforced and the diet should be nutritious and carefully regulated. Rest and fresh air are most beneficial. The child may have to be weaned. Change of air and scene and mental diversion are very useful. Tonics, especially iron and arsenic, are indicated.

XII. DISEASES OF THE NERVOUS SYSTEM.

1. Lesions of the Sacral Plexus.—In a generally contracted pelvis, or in one with a flattened promontory, or in septic pelvic inflammations or exudates, pressure upon the sacral plexus may result during labor or the puerperium. Neuralgia, hyperesthesia, paralysis, anesthesia, and atrophy may occur. The sacral and sciatic nerves are extremely sensitive to pressure, and movement of the leg on the affected side causes extreme pain both in the pelvis and down the leg. The prognosis is favorable, and the treatment consists in the cure of the septic condition if this is the cause, and in the general treatment of neuralgia.

2. Puerperal Neuritis and Paralysis.—*Definition:* Puerperal neuritis is a combination of neuritis and paralysis which is single or multiple and of toxic origin. The form which develops first during the puerperium is believed to be of septic origin. It is also possible for a polyneuritis of pregnancy to extend into the puerperal period. *Etiology:* While puerperal neuritis may depend directly upon a toxin connected with some form of puerperal sepsis, it is likely that a predisposition exists in these cases. *Symptoms:* Puerperal neuritis may be general or localized. The latter type is more common. Localized neuritis may attack either an upper or a lower limb. Puerperal neuritis cannot be distinguished in any way from the non-puerperal type. The generalized form is usually a survival from pregnancy, and is often associated with uncontrollable vomiting. Its consideration, therefore, belongs properly to the Pathology of Pregnancy. The association of polyneuritis with insanity known by the name of "Korsakoff's psychosis" has been seen in pregnant women. The localized type of puerperal paralysis is almost peculiar to the puerperal period. Its onset is usually preceded or accompanied by fever, with evidence of neuritis, such as pain and tenderness. The resulting paralysis may be mild and transient, a mere paresis, or it may be of various grades of severity. The affection may develop early or late after delivery, thus recalling the various periods of supervention of the puerperal psychosis. A favorite locality is the ulnar or median nerve. After a period of hyperesthesia, pain, and tenderness the sensibility to pain, temperature, and touch begins to diminish and motor insufficiency appears with the resulting inability to flex the fingers and adduct the thumb, the reaction of degeneration may develop, and in severe cases muscular atrophy develops rapidly in the ball of the thumb and in the forearm. In rare cases the nerves supplying the shoulder muscles are the seat of the

lesion. When the lower extremities are involved, the peroneal nerve is the favorite site and a traumatic paralysis is closely simulated. When paraplegia develops, it is believed to be due to bilateral neuritis throughout the sacral plexus. This condition is very rare, and when present naturally simulates a myelitis. *Diagnosis:* The recognition of a neuritis should not be difficult. In the peroneal nerve the resulting paralysis, however, is not readily distinguished from the traumatic type. Generally speaking, neuritic paralysis develops at a later period in the puerperium with a history pointing to an acute toxic neuritis and a much more rapid supervention of the reaction of degeneration and muscular atrophy. In paraplegia from neuritis, a spinal origin may be excluded by the fact that the integrity of the sphincters is preserved. *Prognosis:* This depends upon the character of the electric reactions, exactly as in the traumatic form. *Treatment:* The initial neuritis must be treated by rest, sedatives, a hypodermic of morphin, and counter-irritation. Vinay recommends ergotin subcutaneously at this stage, one gram every second day. When the neuritis has subsided, the muscles should be subjected to alcohol frictions and massage.

Traumatic Paralyses.—*Definition:* Traumatic puerperal paralyses are unilateral motor palsies confined to some portion of the distribution of the sciatic nerve, usually the peroneus, and due to compression or contusion of the latter. They belong to the maternal birth traumatisms and their existence becomes apparent soon after labor. *Etiology:* These paralyses were originally confounded with the results of neuritis and other motor palsies of non-central origin. Narrow pelves are believed to furnish a predisposition to these nerve traumatisms. Other alleged contributory factors are premature ossification of the fetal cranium, unduly prolonged labor and the arrest of the head in the pelvic excavation; forceps extraction, etc. It is nevertheless true that these paralyses may result after a labor which is normal in every respect. The great sciatic nerve is known to undergo compression in all labors, but the nerve-trunks which traverse the pelvis are all protected naturally from undue compression, with the exception of the lumbo-sacral, which is exposed to contact with the fetal head, and especially with the high forceps as it crosses the pelvic inlet. The fact that the peroneus branch of the sciatic nerve is the seat of the paralysis in most instances, and that the muscles which it supplies may be seen to contract forcibly during the use of high forceps, is sufficient evidence that the deleterious pressure is exerted upon the lumbo-sacral feeder of the sacral plexus and sciatic nerve. According to Windscheid,* normal spontaneous labor never causes anything beyond a slight transitory peroneal paralysis; the severe and perhaps permanent injuries being traceable always to forceps or unusual delivery. *Symptoms:* As the fetal head passes the pelvic inlet, the pressure upon the sacral nerves causes intense pain throughout the distribution of the sciatic nerves, which subsides after delivery. When paralysis follows, an interval of two or three days generally elapses before it becomes apparent. Various paresthesias and a sensation of coldness may precede the motor anomalies. When the latter appear, they take the form of a paresis of the thigh muscles, but this is merely a transitory forerunner of the actual paralysis which, as already said, tends to affect the peroneus nerve, while the thigh muscles and those of the calf retain their functions. The muscles antagonistic to the paralyzed group throw the foot into an equinus position. The electric reactions of the affected muscles are normal. The condition found is simply a paralysis of the tibialis anticus, extensor communis digitorum, extensor hallucis and pedis muscles. When the patient walks, she lifts her foot much higher than normal to compensate for the loss of power in the extensors

* Sanger and von Herff's Encyclopædia.

of the foot. The gait is characteristic. When the paralysis is of long standing, anomalies of sensation are also present in the cutaneous area supplied by the peroneus. The sensibility to pain, temperature, and the faradic current is more or less abolished, while the reaction of degeneration appears in the muscles. Trophic changes have been noted in some cases. *Prognosis:* The general outlook in these cases is favorable. Even if the reaction of degeneration appears in the muscles, the muscular sense is usually preserved. *Treatment:* The patient should lie in bed and have the affected muscles rubbed and kneaded. If the electric contractility is preserved, faradism should be applied once daily. If the reaction of degeneration develops, the interrupted galvanic current is preferable.

Ocular Paralyses.—These affections vary much in origin and severity. They include hemiopia, amblyopia, and amaurosis. In regard to their origin, they may be due to the occurrence of pregnancy-kidney, and belong then to the pathology of pregnancy. This is true also of paralyses of hysterical origin. Strictly puerperal ocular paralyses are due generally to post-partum hemorrhage, and have even been seen after metrorrhagia from abortion. The strictly puerperal ocular disturbances appear to consist chiefly of hemiopia.

Auditory Paralyses.—These, as far as known, originate during pregnancy and are due generally to nephritis.

3. Hemiplegia and Aphasia.—*Definition:* Puerperal hemiplegia represents paralysis of one-half of the body with or without implication of the speech-center, and is due directly to the puerperal state. *Etiology:* Hemiplegia and aphasia occurring in the puerperium are due either to extravasation of blood or to embolism within the brain, the latter being the more common cause. Extravasation of blood from rupture of a vessel is a condition not likely to occur in the puerperium, and post-partum eclamptic convulsions represent about the only species of violence which can naturally occur during that period. *Symptoms:* Hemiplegic symptoms are doubtless always present in aphasia, but may be so slight and transitory that the loss of speech is practically the only affection. The two conditions may coexist in the full development of each. Puerperal aphasia is chiefly of the motor type. *Prognosis:* When these affections are of hemorrhagic origin, the outlook is grave, although many patients survive. On the other hand, the prognosis is generally favorable in the embolic type, though fatalities do occur. In either type a repetition of the pregnancy would very likely cause a relapse. *Treatment:* As we have already seen that these puerperal affections are made possible chiefly by eclampsia and sepsis, the preventive treatment is embraced in the prophylaxis of these evils.

4. Myelitis and Paraplegia.—Unlike the intracranial affections just enumerated, there is no evidence that any of the various recorded cases of spinal meningitis, myelitis, hematomyelia, etc., which have occurred during the puerperium, represent anything beyond simple coincidence, with the possible exception that in a very few instances the lesions of the cord may have been due to puerperal sepsis.

5. Insanity of the Puerperium.—Insanity of pregnancy continued into the puerperal period hardly belongs to this category. The essential puerperal psychoses do not begin until several days after delivery. A distinction is made between the early and late puerperal psychoses, the latter appearing toward the end of the puerperal period, or at the period in which the menses would ordinarily be re-established. In regard to the type of this species of maternity-insanity, it may be either maniacal or melancholic. A dementia is also recognized by alienists, but it is practically only a terminal stage of one of the primary types.

Etiology.—There is no doubt that the presence of puerperal sepsis in many of the cases is something more than a coincidence. Alienists assure us that since the introduction of antisepsis into midwifery the frequency of puerperal insanity has been marvelously diminished. Many cases of this type of psychosis—such as is seen, for instance, in typhoid fever—are said to exhibit more the nature of delirium than of actual insanity. Again, the coincidence of severe local infection has often been remarked, and gives color to the toxic theory; while a further coincidence of insanity of the puerperium with puerperal mastitis, phlebitis, and other inflammations remote from the genitals helps justify the assumption of this point of view. Of other special contributory factors may be mentioned the exhaustion which follows delivery, extreme prostration being a well-known cause of certain psychoses or of low delirium. In this connection should be mentioned the influence of post-partum hemorrhage. In women already disposed to insanity the physiological adjustment which follows child-birth is doubtless sufficient to set up mental disorder.

Symptoms.—According to alienists, 80 per cent. of all cases of puerperal psychoses begin within the first fortnight, and, generally speaking, the longer the period following the first month the rarer the supervention of this type of insanity. It is generally stated that puerperal insanity is essentially maniacal in contradistinction to the insanity of pregnancy, which tends to the melancholic type. It has even been claimed that no less than 90 per cent. of these pyschoses are maniacal in type. But, as has already been mentioned, much which passes under the name of mania is hallucinatory insanity, and this is especially true of puerperal mania. This affection supervenes with prodromes of hallucinatory character which affect the patient's mind and cause certain peculiarities of disposition and temper. At the same time insomnia also develops. Clinically the expression of the affection comprises an attitude of suspicion and hostility to others, which often extends to the person of the child. Suicidal and homicidal impulses are to be feared. Side by side with the mental aberration we often see characteristic physical changes, such as suppression of the lochia and milk, poor circulation, constipation, etc. But grave affections like peritonitis are sometimes hidden by the psychosis, or, in other words, we may have to deal with a delirium secondary to some local inflammation or general sepsis.

Prognosis.—While recovery is the rule, fatalities are by no means rare, including deaths from terminal dementia. In the fatal cases the cause of death is usually exhaustion, and this termination is said to be common in cases which have the appearance of acute delirium, due to some local or general affection. Many cases are so mild that recovery ensues after a good sleep. In some instances we see recurring insanity with lucid intervals, and a tendency to ultimate recovery. If a favorable termination does not result, the case becomes chronic, with one of three or more possible terminations: ultimate recovery under proper management, terminal dementia, or paranoia,—the two latter incurable. A high pulse-rate is a bad prognostic sign with regard to early fatality. The special prognosis of late puerperal psychoses is good, although the duration is said to be longer than in the early forms.

Insanity of Lactation.—Not much need be said of this type of maternity-insanity. Psychoses which develop after the puerperal period have received this designation. They may be classed, from the etiological standpoint, as psychoses of exhaustion, having the same exciting causes, symptoms, and prognosis as the late puerperal psychoses, from which they can with difficulty be separated.

Treatment.—In cases due to sepsis the infection must first be carefully treated.

(See page 752.) Sedatives will be needed for the maniacal symptoms, and during the whole course of the disease the patient must never be left alone, for fear that she may do herself injury. As in the insanity of pregnancy, the advice of an alienist should be sought. (Compare Insanity of Gestation, page 332.)

XIII. SKIN DISEASES.

1. Sudamina.—This is a trivial affection which appears in infectious diseases as well as in the lying-in period. Vesicles containing a clear, crystal-like fluid appear scattered over the abdomen. They are generally not accompanied by inflammation, break readily, and leave a lightly scaling surface. They owe their appearance to a retention of sweat, the ducts being blocked by swelling of the epidermis which surrounds their lumen. Treatment is hardly necessary, but an astringent lotion, such as calamine and zinc in lime-water, may hasten resolution.

2. Eruptions of Septic Infection.—In addition to those diseases which are due to direct infection of the skin itself, such as impetigo and erysipelas, there are a number of eruptions caused by lodgment in the skin of pus organisms from internal foci. Their diagnosis is very materially aided by concomitant symptoms, an infected uterus, the characteristic temperature movement, arthritis, endocarditis, and all the clinical evidences of pyemia. The cutaneous signs vary greatly. They may consist of an erythema only, or a patch of redness irregular in outline on which is seated a number of pustules in various stages of transformation into crusts. The erythema may fade on pressure or it may not, owing to the presence of hemorrhage. Purpura may be the only sign. There is a septic pemphigus in which bullæ occur on all the surfaces except the palms, soles, face, and mucous membranes.

XIV. GENERAL DISEASES.

The puerperal woman is quite as susceptible to the influences of the general diseases as her non-puerperal sister, if not more so. One must bear in mind, however, that all such diseases are modified somewhat by the peculiar conditions of the puerperal state, and also that there is the possibility in all instances of a mixed infection. These general diseases have already been considered in the section on Puerperal Morbidity, page 741, Part VII.

XV. SUDDEN DEATH IN THE PUERPERIUM.

Sudden death during the puerperal period must naturally include all causes enumerated under the head of Sudden Death during Labor (page 669), since death may not occur until after delivery. But if very soon after the completion of labor, should be ranked in the class with death during labor. There are also some cases in which the act of labor is not so likely to provoke death as is the puerperal state. Thus, after delivery a diabetic patient may pass into the condition of diabetic coma; a patient with contracted kidneys or tuberculosis may develop cardiac paralysis, etc. Again, the mischief may be due

primarily to the act of labor itself, death being deferred until the puerperal period. In hemorrhages of all kinds this happens from the profound anemia induced by the loss of blood. Air embolism is of more infrequent occurrence, but is also deserving of special study.

Frequency.—Sudden death in the puerperal state is by no means rare. Porak was able to report before a meeting of the Paris Obstetrical and Gynecological Society * four cases which had occurred within a relatively short interval. The causes were as follows: chronic heart disease, profound anemia following hemorrhage, air embolus following an intrauterine injection, and embolism of the pulmonary artery.

General Etiology.—Conditions of sufficient importance to require individual discussion are shock, heart disease, embolism, air embolism. It is necessary to consider these conditions separately in order to note the various indications for treatment.

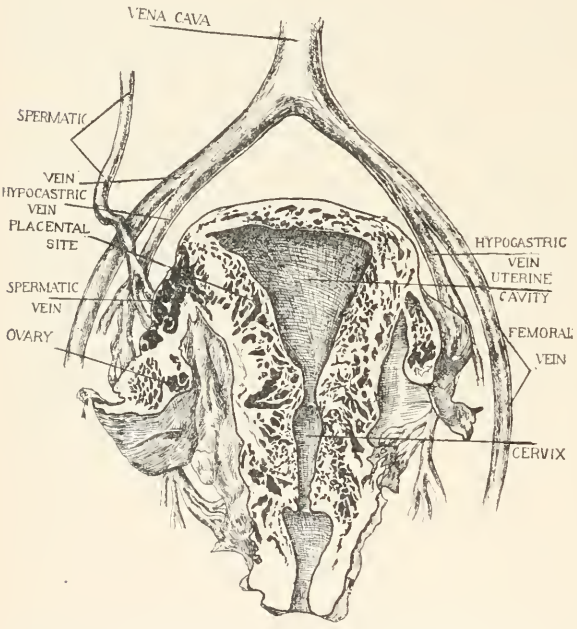


FIG. 978.—ASEPTIC THROMBOSIS OF THE UTERINE AND PARA-UTERINE VEINS IN THE NORMAL PUERPERIUM.

1. Syncope and Shock.—*Syncope* is a natural termination of fatal organic heart trouble, embolism, air embolism, etc. After excessive loss of blood a condition of syncope is also a logical phenomenon. But we encounter fatal syncope at times in patients who have lost no blood, and who present at autopsy no evidence of embolism, thrombosis, or air in the blood, and who have no valvular heart disease. Some of these women doubtless suffer from a certain amount of degeneration of the myocardium. In death from *shock* the fatal termination does not supervene so early as in cardiac paralysis. The patient enters into a state of collapse with rapid and feeble pulse, cold and moist skin, pallor, etc. While shock follows naturally from loss of blood, operative intervention, we also observe it in physiological labor in the highly sensitive woman. The mere emptying of the uterus may produce this condition, doubtless from the sudden lowering of the intra-abdominal pressure. *Treatment:* The management of syncope and shock is practically the same in each affection. Stimulants, such as brandy, ether, strychnin, and camphor, and similar remedies hypodermically with brandy and ammonia by the mouth, are to be employed, with nitrite of amyl inhalations. The foot of the bed should be elevated and the body surrounded by dry heat. Oxygen may be administered. It must be remembered that syncope is not necessarily a dangerous condition, but may be little more than an ordinary fainting attack with a tendency to spontaneous recovery.

* "Le Bulletin Médical," Dec. 14, 1898.

2. Pulmonary Embolism.—This affection may occur during any of the phases of maternity: pregnancy, parturition, the puerperium, and the post-puerperal period. *Etiology:* Pulmonary embolism in the course of pregnancy is due, doubtless, to detachment of a portion of a thrombus in a uterine sinus, which affection in turn is to be attributed to a partial detachment of the placenta, and is sometimes seen as a result of attempts to produce premature delivery. Embolism after delivery may also be attributed in part to a uterine thrombosis, but the development of a thrombotic state of the pelvic, iliac, and crural veins is doubtless the remote cause of most of the cases of pulmonary embolism occurring in the puerperium. In other words, the predisposing causes of pulmonary embolism in the various phases of maternity are comprised under the head of the causes of maternity-thromboses. Exciting causes which determine the production of embolism from thrombosis are sometimes evident. The phenomena of embolism have occasionally followed paroxysms of coughing, the act of rising in the bed, and efforts at defecation. But such are not necessary for the detachment of a portion of a thrombus. The clot of blood may be extremely friable, and this is especially true in septic cases. *Symptoms:* Pulmonary embolism expresses itself clinically by well-marked types, depending on the degree of obstruction within the pulmonary circulation. In the fulminant or apoplectic type the patient immediately drops dead. In a less severe type there is a brief interval of irregular pulse, dilated pupils, and dyspnea before death supervenes. A third type, while fatal, may not destroy life for some hours. The symptoms begin with anxiety, a marked degree of dyspnea, and restlessness, the patient passing quickly into a state of collapse, with an icy feeling, and a vanishing pulse. The mode of death in these cases is acute pulmonary edema. The preceding types are necessarily fatal by reason of the large calibre or the number of the obstructed vessels. In a second class of cases the affection, while severe, is not necessarily fatal. The symptoms agree closely in character with those produced by shock. There are a cadaveric pallor, a pulse barely distinguishable, and extremities of icy coldness. In a small proportion of cases premonitory symptoms of embolism occur. Sudden diminution in the volume of a milk leg should be sufficient to awake anxiety in the mind of the medical attendant. One observer (von Herff) has had this warning in two of his personal cases. Other premonitions have been noted—pain in the left shoulder-joint, angina pectoris, etc. *Diagnosis:* The recognition of pulmonary embolism is often very difficult or for an inexperienced practitioner even impossible. Even experts may be deceived, and it is related that a specialist of immense experience in this field once diagnosticated pulmonary embolism as ruptured tubal pregnancy with fatal hemorrhage. The symptoms pointing to the lungs are not well defined, for if the embolism is sufficient for the production of dyspnea and cyanosis, the picture of collapse develops. If the patient is not destroyed quickly by the disease, the symptoms of hemorrhagic infarction develop which should be easy of recognition. *Prognosis:* The prognosis can be discussed only from the standpoint of the chances of ultimate survival after the patient weathers the first shock of the disease. (See Hemorrhagic Infarction.) *Treatment:* There is no treatment for the fulminant type of the affection. If the patient survives the first onset, she should be treated for the coincident shock by rest, hot applications, and cardiac stimulants. In order to prevent the deposition of fresh emboli in the lungs, absolute rest is indicated and should be continued for weeks.

3. Primary Thrombosis of the Pulmonary Arteries.—Embolism from fragments of coagula is by no means the sole lesion of this sort encountered in connection

with maternity, for primary thrombosis may develop in the arteries of the lungs in cases in which puerperal phlebitis and thrombus are absolutely non-existent. In past years the question of the relative frequency of primary and secondary thrombosis has been actively debated. Some have gone so far as to state, with Playfair, that the majority of cases are primary rather than secondary. A third variety of thrombus may be due to clotting in the right heart, a detached portion of the coagulum plugging the artery; but practically we may regard such a case as primary, restricting the term secondary to cases in which the parent thrombus forms in a pelvic vein. The consensus of opinion is that primary thrombosis of the pulmonary arteries during the puerperium is a rare occurrence, and that the great majority of cases of sudden death from obstruction of the pulmonary arteries are due to embolism. Clinically there is no method by which primary and secondary cases may be differentiated.

4. Air Embolism.—This accident, which may occur either during or after labor, is by no means as common as pulmonary embolism proper, but doubtless ranks as the next most frequent cause of sudden death in connection with maternity. *Definition:* Air embolism is simply a form of pulmonary embolism in which the blood-vessels are obstructed by air bubbles which have found their way into the circulation through the uterine veins. *Etiology:* For air embolism to occur there are required a number of factors acting in concert. Air must have entered the uterine cavity from without (or gas must have been formed within); the uterus must be uncontracted; the uterine sinuses must be patulous; and, finally, a certain amount of air must have obtained access to the circulation, since the ingress of a small quantity may not give rise to embolism. For air to enter the uterine sinuses before delivery, the placenta would have to be detached prematurely to a greater or less extent. This accident has actually happened before labor in connection with attempts to induce premature delivery. In cases of this sort the relation of cause and effect is very apparent; since the air which is often injected with the water by a bulb syringe may pass directly into the circulation. Air may doubtless enter the birth tract from the difference in the pressure within and without the abdomen, its ingress being favored by a patulous condition of the vulva, such as exists immediately after delivery, and by all kinds of manual and instrumental intervention. The relaxation of the uterus which follows a pain should also be enumerated among the possible factors in the aspiration of air by the uterus. The air which enters the circulation may not proceed from without, since it may be generated in the uterus as the result of the death and putrefaction of the fetus, and enter the veins only after removal of the latter with the placenta. The *symptoms* are entirely similar to those of pulmonary embolism in general. *Treatment:* As in the case of ordinary thrombotic embolism, the management consists in prophylaxis and in the treatment of the pulmonary lesion *per se* in case the patient survives. Prophylaxis consists in the greatest care in all procedures which might possibly introduce air into the vagina or uterus, such as the induction of labor, vaginal and uterine irrigations, and the introduction of the hand for various operations. The secret of the prophylaxis, aside from the foregoing, is a firm grasp upon the fundus and uterine body before and during all vaginal and uterine manipulations.

PART EIGHT.

The Physiology of the Newly Born.

I. GENERAL PHENOMENA. (Page 779.) Establishment of Respiration. Changes in the Fetal Circulation. Umbilical Stump and Ring. Temperature. Pulse. Meconium. Feces. Urine. Digestion. Liver. Heart. Blood. Weight. Signs of Normal Nutrition. Breasts. Shape of Head. Sutures and Fontanelles.

II. HYGIENE AND MANAGEMENT OF THE NEWLY BORN. (Page 785.) First Care. The Bath. Care of Cord. Dressing the Child. INFANT FEEDING. (1) Maternal Nursing. (2) Wet-nurse. (3) Artificial Feeding. (4) Patented or Proprietary Foods. Open Air. Sleep. Bladder and Bowels. The Nursery. Environment. Weaning.

I. GENERAL PHENOMENA.

Establishment of Respiration.—Until the fetus has ended its stay *in utero* and is finally expelled into the outer world, its lungs are normally in a condition of complete atelectasis. The first respiration, however, is accomplished as soon as the fetus has entered the external atmosphere. Notwithstanding the many theories advanced, respiration is probably not caused by any one agent alone, but by the combined influence of at least two important conditions affecting the respiratory center in the medulla oblongata. The first and most important is stimulation of the respiratory center through the nervous system, and, secondarily, stimulation of this center through changes in the fetal blood. For the sake of convenience we consider the latter first. Changes in the fetal blood are brought about by a shutting-off of the oxygen supplied to the fetus; for the strong and tonic contraction of the uterus immediately following fetal expulsion constricts, if it does not entirely occlude, the placental blood-vessels which have carried on intrauterine respiration. As a result of this, the supply of oxygen through the umbilical vein, which has furnished the fetus an abundance, is cut off. Following this stoppage a proportionately larger amount of carbonic acid accumulates in the fetal circulation, as, for the same reason that the oxygen supply is lost, carbonic acid gas absorption by the placenta is also shut off. Carbonic acid gas greatly stimulates the center of respiration and respiratory action is established. The cause is occasionally illustrated as acting singly by the efforts of the fetus to respire before birth. The fetus leaves a liquid cushion with a temperature of 99° F. and quickly passes into the air of the lying-in room, usually at a temperature of 70° F., or 29° F. lower. This change produces an irritation of the skin, the shock of which is alone sufficient to cause a reflex action of the muscles, and a stimulation of the respiratory center. This fact is illustrated by our ability to induce respiratory effort in cases of suspended respiration in the newly born by the skin irritation caused when we immerse an infant alternately in hot and cold water, after the accumulation of carbonic acid gas in the blood fails to stimulate the respiratory center. It is easy to conceive of this mechanical irritation being alone sufficient to produce respiration, and therefore that this is the first great cause. With the first respiration the muscles both of ordinary and extraordinary respiration are brought into action, as shown by the lusty cry usually uttered at the moment of birth. By this too, the chest-walls, before unexpanded,* expand and remain so; the diaphragm is drawn up, the muscles of the nose and throat become active, and the physiological function of respiration is thoroughly established. The rate of respiration at birth varies physiologically between 40 and 45, being a little more frequent in females than in males, as in after life, and a little less frequent in large robust infants than in weakly ones. The breathing in the infant is almost entirely abdominal, as the diaphragm is the chief muscle causing it, the chest-walls and intercostal muscles taking very little part after the first few respirations, until later in life. Auscul-

*According to Ballantyne, rhythmic movements of the thorax occur *in utero*. This abortive activity may be due to a precocious action of the respiratory center.

tation of the newly born reveals the presence of fine crepitant râles as the lungs expand.

Changes in the Fetal Circulation.—Concomitant with the establishment of the first respiratory action, there occurs a change in the fetal circulation, as the oxygenation is no longer carried on through the placental circulation. This is now accomplished by pulmonary respiration in the infant. As the placenta is now useless, the functions of the omphalic vessels no longer exist, and the circulation connected with them ceases. In order clearly to understand these changes, it is important that the fetal circulation should be thoroughly understood. (See page 79.) Coincident with the first respiration the blood is diverted from the umbilical vessels, and is at once,—by aspiration, as it were,—following the drawing up of the diaphragm and expansion of the chest walls, carried through the pulmonary arteries and distributed by its capillary terminals to the vessels of the lungs. By this sudden change in the chief fetal blood-currents, equally important changes occur in the circulatory apparatus itself. The abdominal continuations of the umbilical vessels close and by thrombosis and atrophy become organized into strong, hard, fibrous cords. There being no propelling force of blood through the ductus arteriosus, it also closes. The blood, instead of being directed through the foramen ovale by the Eustachian valve, now passes into the right ventricle, and hence the usefulness of the valve and foramen is lost, the foramen closes, and the valve contracts. From the right ventricle the blood is forced into the pulmonary artery, and as there is no longer excessive pressure in it—as the capillary terminals in the lung are open—there is not the tendency of the blood to pass on into the aorta through the ductus arteriosus, the current to the lungs being no longer dammed back upon the pulmonary artery and this duct. The duct therefore collapses or contracts. By thrombosis here also organization begins, and in later life the duct is distinguishable only as a round cord. The blood is both forced and aspirated into the lungs through the pulmonary artery. From the lungs it is returned reoxygenated to the left auricle through the pulmonary veins, and is then ready to furnish nourishment to the entire economy. It is therefore pumped into the left ventricle through the auriculo-ventricular orifice, and thence into the great blood-main of the body, the aorta, whence it is distributed through the branches, terminals, and capillaries. That these changes are anticipated during fetal life is shown by the fact that the ductus arteriosus and ductus venosus do not increase in size in the same ratio as the aorta, venæ cavæ, etc.

Umbilical Stump and Ring.—A line of demarcation appears at the base of the umbilical stump at the end of twenty-four hours; necrosis of the covering of the cord and mummification of the jelly of Wharton follow (Figs. 979, 980, 981). The remains of the umbilical vein and arteries are gradually destroyed. The line of demarcation deepens and the stump falls at about the fourth day (Fig. 981). Retraction of the granulating remnant of stump within the umbilical ring follows and is apparently complete about the tenth day (Fig. 982). The umbilical ring is merely the opening in the abdominal wall around which the cord substance is fastened and through which the umbilical vessels pass. There is a distinct line of division from the cord substance, about a fourth to a third of an inch from the abdominal wall, which pouts to form the ring. This line, which also marks the point of separation of the cord, is distinguished from the soft, gelatinous, pearly-white substance of the placental end of the cord as a red ring formed of a network of capillary blood-vessels covered by a very thin, delicate skin. The ring, after the falling off of the cord on the fourth or fifth day, leaves a healthy granulating surface which soon cicatrizes (Fig. 982).

FIG. 979.—UMBILICAL STUMP AND RING A FEW HOURS AFTER DELIVERY.

FIG. 980.—UMBILICAL STUMP AND RING ON THE SECOND DAY.

FIG. 981.—UMBILICAL STUMP AND RING ON THE FIFTH DAY.—CORD SEPARATING.

FIG. 982.—UMBILICAL RING ON THE TENTH DAY.

Owing to this cicatricial contraction and to the shortening of the intra-abdominal remains of the umbilical vessels, the ring sinks into the abdominal wall to the depth of a fourth or a third of an inch as a small, puckered scar, and remains thus through life as the navel or umbilicus. This is always wider and deeper in the female than in the male.

Temperature.—At birth the fetal temperature varies slightly, averaging about 99.5° to 100.5° F. This is about 0.5° to 1° higher than the vaginal temperature of the mother. It is what would be expected, as the fetus has been encompassed in the uterus by a liquid cushion at the internal maternal temperature of 99° F., which can take up very little of the temperature of the fetus, as radiation from this liquid must be slight. Hence the metabolic changes occurring in the growing fetus are sufficient to keep its temperature about 1° F. higher than the maternal temperature. Soon after birth the temperature has fallen about 1.8°, but again reaches the normal infant temperature of 99.4° F. in about twenty-four hours. The temperature varies irregularly during the first few weeks of life, being elevated sometimes even 0.5° by prolonged and vigorous crying, and dropping 0.6° to 1° during sleep.

Pulse.—The pulse-rate in the newly born varies between 130 and 140 per minute, depending upon the activity and robustness of the child, also being slightly faster in a healthy female than in a male. As has been stated, the respirations are much more rapid and shallower in the infant than in later life, and the temperature is higher. An increased pulse-rate would consequently result. This rate varies greatly physiologically, being increased from 20 to 30 beats per minute by muscular activity from any cause, such as crying or being raised from the recumbent to the upright posture. Great excitement sometimes increases its frequency and also its force. It may in perfect health, especially when very rapid, be very irregular physiologically. As throughout life, it varies in proportion to the respirations and temperature, though much more irregularly.

Meconium; Feces.—A study of the stools in infancy is valuable not only on account of the information it gives concerning the alimentary processes, but also because it determines in a great degree the necessary strength and quantity of the infant's food. Besides, it aids us in determining the nature of many of the disturbances so frequent at that period of life. The newly born infant passes stools greenish-black in color, known as meconium, composed of mucus, bile. vernix caseosa, epithelium, hair, fat crystals, phosphates, and bacteria. After the fourth or fifth day the stools of a baby fed upon milk alone, whether from breast or bottle, should be yellowish, pasty in consistency, of acid reaction, and not disagreeable in odor. The color is due to bilirubin and the reaction to lactic acid, the source of which is the milk sugar. Mucus and epithelium are always present. Miller, who has carefully studied the various micro-organisms in the mouth, found that the majority of them could again be located in the intestinal canal. In the feces, two germs, Bacterium lactis aerogenes and Bacterium coli commune, are the most important. In the first two weeks the stools number from three to six each day; after the first month they vary from one to three daily—the average being two each day. Later in infancy, when other articles are added to the milk diet, the stools, while remaining soft and watery, become darker in color and contain a greater variety of bacteria. The gases present are hydrogen (H) and carbon dioxide (CO_2), the adult odor being acquired later, due to the presence of hydrogen sulphide (H_2S). The bulk of the stool is composed of about 85 per cent. water, and fat varying in amount from 2 to 4 per cent. Pathologically the stools may assume one of a variety of colors and con-

tain any of a long list of materials. Green stools are of very frequent occurrence. When very acid or thin, they often cause irritation of the buttocks and are accompanied by colic. The green color is due to pre-formed bilirubin. These stools usually contain more or less undigested casein and fatty acids. Stools varying in color from pale greenish-yellow in the early stages to grass green later, are seen in cases of acute intestinal indigestion, the result of improper feeding. An excess of sugar causes thin, acid, green stools. Bismuth, tannic acid, and the iron salts color the stools from deep brown to black. Blood gives the characteristic tarry stool when the blood is admixed higher up in the intestinal canal; when lower down, it is brighter red in color. An excess of mucus indicates some inflammatory condition of the large intestine. Light or light gray stools of a pasty consistency, or in dry balls, contain an excess of fat and are usually offensive in odor. When proteids are in excess or too much food is given at a time, curds appear in the stools, sometimes with diarrhea, but more often with constipation and colic. Curds are especially liable to occur in infants fed upon cow's milk, particularly when sterilized.

Urine.—As a rule, almost immediately after birth the infant voids urine at or just before the time it passes meconium. It is of a slightly urinous odor, aqueous in color, markedly acid, specific gravity 1004 to 1010, containing an unusual amount of albumin in 33 per cent. of cases, a few granular and numerous hyaline casts, an inordinate amount of uric acid, and frequently some sugar. These are all characteristics of the urine of the newly born. In a short time, varying from three days to three months, these change. In about three days the specific gravity drops to from 1003 to 1006, the albumin disappears with the casts, epithelium, and excessive mucus observed at first. The urine is passed frequently during the waking hours, but less frequently during sleep. Normal urine should not stain the napkin.

FIG. 983.—LOWER CENTRAL INCISOR TOOTH EXTRACTED WITH THUMB-FORCEPS FROM AN INFANT TWO DAYS OLD. The tooth interfered with nursing by causing an erosion of the nipple.—(*Case at the Emergency Hospital.*)

Digestion.—As milk contains all the nutritive principles found in the various foods ingested by the adult, we would expect to find in the infant the numerous digestive agents necessary in adult life, and such is the case, though they are present in smaller quantities. Besides these, there is in the stomach, in proportionately larger quantity than in adults, a ferment especially adapted to the infant food, known as the rennet ferment, the action of which is to curdle milk on its entrance into the stomach. As the milk rapidly passes through the mouth during nursing, there is very little use for saliva, with its power of changing starch into sugar. The milk having been sucked into the mouth, it is swallowed at once. Owing to the small amount of saliva, and consequently of ptyalin, and also of the deficiency of the pancreatic secretion, provision for the digestion of starches is lacking in young children. The practical application of this fact will be noted in connection with infant feeding. With the above exception infantile digestion is accomplished in the usual way. It is aided, however, by the presence of bacteria in the alimentary canal. As soon as milk enters the stomach the rennet ferment causes a soft flocculent curd to be formed. This is the chief part of gastric digestion in the infant, as the pepsin and hydrochloric acid begin to digest this curd only when it is passed on into the intestine. It will be remembered in this connection that in the newly born the stomach serves more the part of a reservoir than of a digestive organ. The proteids have been partially

Fig. 984.—Meconium Stool. First Day.

Fig 985.—Normal Yellow Stool. Breast-fed Infant. Tenth Day.

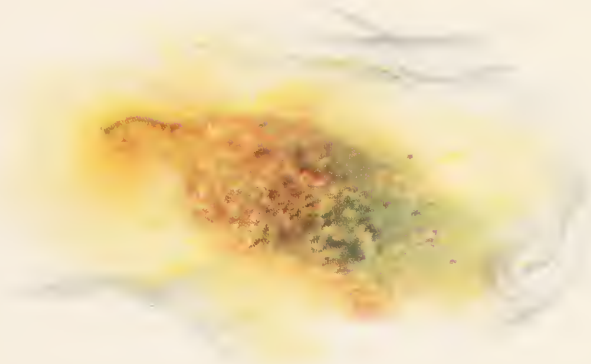


Fig. 986.—Slightly Greenish Stool, with Small White Curds, from a Breast-fed Infant, Apparently in Perfect Health. Sixth Day.

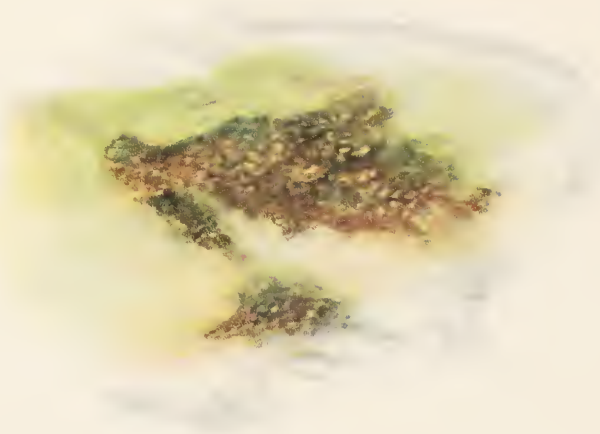


Fig. 987.—Greenish Stool, with White and Dark Curds, from a Breast-fed Infant, with Apparently Good

changed into peptones and some absorption has taken place. Having been poured into the intestinal tract, the milk is here brought in contact with the pancreatic secretion, which contains all the ferments necessary for converting more completely the proteids into peptones, for emulsifying fats, and for changing starch into sugar. Here, too, it is brought in contact with the bile from the liver, which further helps to emulsify the fats. These fats are principally absorbed from the small intestine, as are also the peptones, salts, and sugar; the glands of the large intestine are as yet imperfectly developed, hence its absorbing power is slight.

Liver.—At birth it is well to remember the very large size of the liver in proportion to the body, it being about one-thirtieth the entire body-weight. This is readily understood when it is remembered that the liver and the head are nourished in fetal life by the practically pure freshly oxygenated blood, and consequently these parts are well developed. Immediately after birth the secretion of bile is lessened because of the diminished blood-supply to the liver. Pressure upon the hepatic veins is lessened. During exfoliation of the stump of the cord the capsule of Glisson may become swollen.

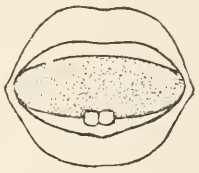


FIG. 988.—TWO MIDDLE LOWER INCISORS. Appear third to tenth month; average, seventh month.

Heart.—At birth the heart is relatively larger in comparison with the body-weight than at any other time of life. The walls of the two ventricles are found to be nearly of the same thickness, for the two sides of the heart have been doing about the same amount of work. At birth the work thrown upon the left ventricle is greatly increased, in comparison with the right, hence the left increases in thickness more rapidly, and later in life we find that it has reached the proportion of about 2 : 1 instead of about 6 : 7 as at birth. The heart's action is much more frequent at birth than later, being also more frequent and less regular in females than in males. Its position is not so oblique as in the adult. The apex impulse is farther to the left than later in life, and usually for the first few days is just outside the mammary line in the fourth intercostal space. The sounds are much louder comparatively than in adult life, owing to the thinness of the chest-walls and the greater area of cardiac dulness—the lung not overlapping the heart to so great an extent.

FIG. 989.—FOUR UPPER INCISORS. Appear ninth to sixteenth month.

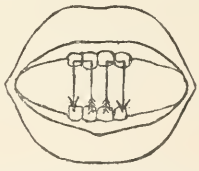


FIG. 990.—ORDER OF THE ERUPTION OF THE EIGHT INCISORS (MILK TEETH).

Blood.—At birth the proportionate amount of blood is less than in the adult, averaging about $\frac{1}{19}$ the body-weight, while later in life it is about $\frac{1}{18}$. This varies in the newly born, depending largely upon the time when the umbilical cord is tied. In immediate ligation the weight may be only $\frac{1}{18}$, while if ligation is postponed until cessation of pulsation in the cord it may be even greater proportionately than in the adult, often being as high as $\frac{1}{10}$ the body-weight. While the specific gravity and hemoglobin are higher, and the proportionate number of red and white cells is greater, and the proportion of white cells to red is also increased,—about 1 : 160,—the blood is thinner, more watery, contains less fibrin, and therefore does not coagulate or clot so readily as adult blood. There is also a much greater variation in the size and appearance of the blood-corpuscles, as the blood-glands continue to form new cells in greater quantities for about three days.

Weight.—At full term an average fetus weighs about 7.3 pounds. The weight varies largely, as would be expected, depending on numerous influences which it is well to mention: (1) Depending upon the parents. (*a*) The size of the parents seems to influence somewhat the size of the infant; infants born of parents of large stature are, on an average, larger than those whose parents are small. (*b*) Strong, healthy parents may also expect larger children than do those in feeble health. (*c*) The age of the mother seems to influence the size of the infant,—women between twenty-four and thirty-four bearing the largest children, as this is the prime of motherhood. (*d*) Parity. The offspring of primiparæ average less in size and weight than those of multiparæ. Also, each fetus seems to weigh a little more than the preceding one when sufficient time elapses between births. (*e*) Frequency of child-birth greatly influences the size of the fetus, as in pregnancies rapidly following one another each succeeding child is less robust. (2) Sex. Males average a greater weight than females. There is for three days a continuous loss in weight, due partly to the frequent discharge of urine and feces, but largely to the excess of tissue waste over tissue reconstruction. This averages about 11 per cent. of the body-weight. The weight is gradually regained, however, from the third day on, and by the tenth day has reached the weight at birth. This steady increase should thereafter continue uninterruptedly in a healthy child.

Signs of Normal Nutrition.—The end of the first week of life generally finds an infant at the weight accredited to it at birth; the slight loss attendant upon the elaboration of the mother's milk during the first three or four days is made up at the end of the first week. After this period the weight of a properly developing infant will increase from 6 to 8 ounces each week, or, roughly speaking, an ounce a day for the first two or three months. At the end of the fifth or sixth week this gain is slightly lessened, but it is steady. Taking seven pounds as the average weight of an infant at birth, it should weigh fourteen pounds at the end of the first five months and twenty-one pounds at the end of the first year.

TABLE SHOWING THE GAIN IN A HEALTHY INFANT FED AT THE BREAST

Normal weight at birth, 7 lbs.		Gain at end of first week, none.	
Weight when 2 weeks old, 7 lbs. 6 oz.		" " 2d " 6 oz.	
" " 3 " " 7 lbs. 14 oz.		" " 3d " 8 oz.	
" " 4 " " 8 lbs. 6 oz.		" " 4th " 6 oz.	

In a breast-fed infant when the weight does not increase, the milk should be examined to determine which ingredient is at fault. Any failure to gain steadily in a baby fed upon modified milk warrants a change either in the quantity or the strength of its food. Besides the gain in weight, which emphasizes more strongly than any other factor that the baby is thriving, its general condition, whether it is comfortable, its sleep quiet and sufficient, the stools, with their number, color, and consistency, should be taken into consideration. It is not a rapid but a steady gain in weight which is all-important.

Breasts.—At birth the breasts of the infant are sometimes found to be comparatively large, swollen, and secreting. This secretion is greatest usually at the end of the first or beginning of the second week. At this time the glands are increased in size, red, with elevation of temperature, rather hard, and very sensitive. The vessels are turgid and the whole merely presents a picture of a functionating gland (Fig. 970). Normally this secretion continues only for about two weeks, but may be found much later, the secretion itself being about the same in appearance as the mother's milk. The amount of secretion is the

same in the two sexes, it being merely a physiological gland activity. No harm commonly results, but all manipulation or attempts to express secretion should be forbidden, since they may result in the development of an abscess. (See Part IX.)

Shape of Head.—After moderate moulding during labor, the head usually resumes its normal shape in four or five days. In the excessive moulding of persistent occipito-posterior positions, in temporary mento-posterior positions, and in presentation of the anterior parietal bones (Naegele's obliquity) a return to the normal contour may be delayed as long as two weeks or more. I have tracings of the head taken at birth in the first and second of the above positions, and also one and two weeks after delivery, showing the tardy return to the normal. The caput succedaneum rapidly disappears even when extensive. Change in shape largely due to a cephalohematoma may persist for two or three weeks, or until the blood-clot is absorbed. (See Part IX.)

Sutures and Fontanelles.—The edges of the cranial bones are normally in apposition at birth. Separation is commonly due to prematurity, syphilis, or rachitis. Ossification does not usually occur until the end of the sixth month or later. The posterior fontanelle is usually closed about the end of the second month and the anterior about the eighteenth.

Post-mortem Observations.—These in the infant should include (1) the relatively large size of the thymus gland and heart; (2) whether the thymus obstructs the trachea; (3) whether the lungs are inflated and overlap the heart; (4) the relatively large size of the bladder, sigmoid flexure, appendix, and liver; (5) infection of the hypogastric arteries from a septic umbilical ring.

II. HYGIENE AND MANAGEMENT OF THE NEWLY BORN.

First Care of the Infant.—After the cord has been tied and cut and the eyes have been washed with a solution of boric acid, the baby should be wrapped in a soft, warm piece of flannel, laid in some convenient place out of harm's way, and covered with a shawl or other covering, taking care to allow sufficient breathing space. Here it may remain till the mother has received proper attention. It should occasionally be noted that the respirations are regular and that there is no oozing from the cord (page 489).

The Bath.—After making the mother comfortable the nurse may attend to bathing the child. The necessary articles have been provided and stand ready for use, in winter near a fire or register. They consist of a small tub or bowl of water at 95° to 100° F., a soft rag, and a warm, soft towel. The nurse should wear a flannel apron or may have a flannel apron or petticoat spread over her lap. The vernix caseosa is miscible with sweet oil and is best removed by a free use of oil. The infant is then gently sponged with a soft cloth and tepid water. Only a small part of the body is bathed at a time, the rest being kept covered. The bathing is done in the warmest part of the room, before the stove, register, or best an open fire. All manipulations should be gentle, and feeble or premature children should not be washed, the vernix being cautiously removed, care being taken that the surface does not become chilled. It is better not to give a tub-bath till the tenth day, as it is something of a shock, and its repetition tends to prevent healing and desiccation of the umbilicus and may result in infection. The usual tendency is toward too much bathing, scrubbing, and exposure. During the first ten days the child should be cleansed

daily as above described. Soap should be used moderately, and chiefly about the genitals and axillæ. Fine castile soap is to be preferred. Powders are unnecessary except about the genitals and flexures of the joints and folds of skin; powdered starch, talc, or lycopodium may be used.

Care of Cord.—The cord should be dusted with a non-toxic antiseptic or aseptic powder, as pulverized boric acid or sterile starch, wrapped in borated absorbent cotton, and kept as dry as possible. Since septic infection may occur at the umbilicus, the nurse should carefully disinfect her hands before touching this region. After separation of the cord the umbilicus should be kept perfectly clean, but not washed more than necessary, and should be dusted with powdered boric acid or sterile starch.

Dressing the Child.—The infant's clothing should be warm, loose, easily removed, and not irritating. The band is unnecessary, and when pinned as tightly as is often done, is decidedly injurious by interfering with respiration and leading to defective development of the abdominal wall. If used, it should be applied loosely, should be of flannel or knitted wool, and should extend from the pubis to the axillary region. The undershirt should be of soft flannel, with high neck and long sleeves, and buttoned all the way so that it can easily be removed. The dress should be of flannel, twenty-five inches from neck to hem, opening in front; over which may be worn a muslin slip, opened behind if desired. Long woolen socks should be added and the baby is dressed. Diapers should be of old soft linen or cotton diapering; they should not be hemmed, as this makes little ridges. They should be rough dried, as ironing makes them hard and less absorbent. They should be changed as soon as wet and not used again without washing. If used without washing, they cause chafing. Infants are, as a rule, too warmly clad in summer. The amount and quality of the clothing should be changed according to temperature, so that sudden chilling of the surface may be avoided. In cold weather it is necessary to protect the baby thoroughly, but if the house is kept at the average temperature of American homes, a more decided difference than usual should be made between the indoor and outdoor garments.

FIG. 991.—DIAGRAM SHOWING STERILE GAUZE DRESSING FOR UMBILICAL CORD.

INFANT FEEDING.

1. Maternal Nursing.—After delivery is completed and the abdominal binder is applied the patient must be allowed a number of hours of sleep, after which the child may be placed at the breast. The suction exerted by the infant at this time favors the contraction of the uterus, assists in the formation of the first milk, and abstracts the colostrum from the breasts. The latter substance is supposed to exert a favorable influence on the digestive apparatus of the infant. Whenever possible the mother should nurse her own child, since the nutriment thus supplied is unquestionably the most natural and wholesome food in the earliest period of life, and it can be proved that involution is more satisfactory in women who nurse their children. Unfortunately, this is not always possible for a variety of reasons, some of which are due to the strain of modern civilization and abnormal environment, others of which

depend upon deformity or disease on the part of the mother or child. Some of the most important conditions are, on the part of the mother, syphilis, phthisis, mammary abscess, marked anemia, and depressed or absent nipples; and, on the part of the child, harelip.

The secretion of milk is usually established in the second twenty-four-hour period after delivery, and it is not necessary to supply any form of nutriment to the child before the expiration of that period, except what it gets from the breast. Warm water, however, should be freely administered. It is a mistake to give milk and water, sugar-water, or any artificial food during this period; though if proper milk secretion is not established by the beginning of the third day, it may be necessary to begin artificial feeding at least temporarily. Even in the first two days of life it is practicable to feed infants with a modified milk containing a very low percentage of proteids, about 0.25 to 0.5 per cent. Such infants do not lose weight, as is often the case when all food is withheld for this time. (See Treatment of Prematurity, page 802.) When the flow of milk is properly established, the child must be trained to nurse at regular intervals, and it must not be put to the breast every time it cries. The proper intervals vary somewhat according to the age of the child, and may be roughly estimated as follows: Up to the age of six weeks, every two hours between 6 A.M. and 10 P.M., and one feeding between 10 P.M. and 6 A.M.; from six weeks to four months, every two and a half hours, with one night feeding; from four to nine or ten months, every three hours, without any feeding between 10 P.M. and 6 A.M. Water may be given occasionally between feedings. Each breast must get its share of use, and it is best to alternate regularly. The child should be allowed to nurse for fifteen or twenty minutes and no longer. Irregularity in feeding is a prolific cause of indigestion and flatulence in the infant, and is often the cause of maceration of the nipple, besides being a great annoyance to the mother. If the child shows an inclination to nurse longer than twenty minutes, it indicates that there is a deficient supply of milk in the breast. Failure to nurse satisfactorily may be caused by placing the child in such a position that it cannot secure a proper hold on the breast and has to seize the nipple obliquely, or the child's nose may be pressed so closely against the breast that breathing may be interfered with and thus satisfactory nursing becomes impossible. These are matters very easily regulated, and though apparently insignificant, should never be neglected. The physician should satisfy himself by actual observation that all is being done properly, since carelessness and lack of knowledge are all too common.

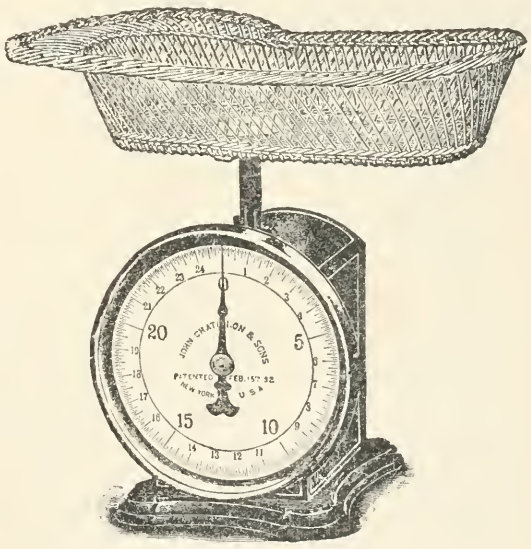


FIG. 992.—BABY SCALES.

The average composition of average normal human milk is put down thus: fat,

4.00; sugar, 7.00; proteids, 1.50; alkaline reaction and no bacteria. Variations occur frequently, but between moderate limits are not significant and do not disturb the infant's digestion. The quantity of milk may be increased by attention to the general health of the mother and by allowing plenty of fluids. Cathartics and curtailment of fluids have the opposite effect. Malt preparations, milk, and gruel seem to have a special faculty of increasing the milk-supply. The quality of the milk may vary from over-rich to bad. Too much rich food, improper habits of life, and insufficient exercise will cause the milk to contain too high a proportion of solid ingredients, the chief disturber of the infantile digestion being the increase of proteids. The remedy for the condition is obvious. A poor milk usually contains too much proteid and a subnormal amount of sugar and fat, while a bad milk accentuates this disproportion. Overwork and improper diet will cause the milk to be poor, while the causes of the production of a bad milk are usually put down as neurotic.

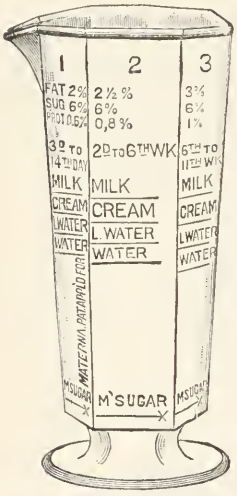


FIG. 993. — MATERNA GRADUATE GLASS FOR ARTIFICIAL INFANT FEEDING.

2. **Wet-nurse.**—The best substitute for the milk of the mother is the milk of a healthy woman who is nursing a child of about the same age as the infant she is to feed. To be a desirable wet-nurse, a woman should, in addition to having a child of about the same age as the child she is to nurse, be free from any communicable disease, such as tuberculosis, syphilis, or gonorrhea; she should have a good quantity of milk and the nipples should be normal in development and general condition. If possible, her child should be examined for evidences of syphilis, which when it occurs is sometimes more evident in the child than in the mother. Until the character of the nurse is proved, she should be watched while she is nursing the child, and if all goes well, the result will be as good as if the child were nursed by its mother. The diet of the nurse will, of course, require supervision, and in many cases it will be necessary to guard against overindulgence in malt liquors. There is no more difficult or thankless task than the procuring and supervision of a wet-nurse, and she has been defined by some one "as one part cow and nine parts devil."

3. **Artificial Feeding.**—This must be resorted to when the mother cannot nurse her child and a wet-nurse is not available. It is only when maternal nursing is impossible or when it presents conditions which are unsuitable, such as when the milk is unreliable in quantity and too poor in quality properly to nourish the child, that artificial feeding should be resorted to. Breast-milk practically does not change its composition during a normal lactation, but it has been observed that infants cannot take so rich an artificial food as a natural one, and it is necessary to alter the proportion of some ingredient in preparing the artificial food. In certain cases the woman can supply a portion of the milk required by the infant and the deficiency must be made up by the use of a modified cow's milk. The intervals between feedings must be just as carefully regulated as in the case of nursing. It is also necessary to regulate the amount of food given at a time. A good rule is at the age of one week to give one ounce each time; at four weeks, 2½ ounces; at three months, 4 ounces; at six months, 6 ounces; and gradually to increase to 8 ounces, which is as much food as a child should ever take at a time until weaned. The best results are obtained by

making certain modifications in the ingredients of cow's milk to make it conform to human milk, and by starting with a very low proportion of fat and proteid, gradually increasing as the child approaches eight or nine months. The various strengths which seem to give the most satisfactory results at various ages are thus tabulated. The ingredients should be, in the first months of life:

	Fat.	Sugar.	Proteid.
First week	2.00	5.00	0.50
Second "	3.00	6.00	0.75
First month	4.00	7.00	1.00
Second "	4.00	7.00	1.50
Fourth "	4.00	7.00	2.00
Sixth "	4.00	7.00	2.50
Eighth "	4.00	7.00	2.75

A properly constituted artificial food must contain only substances normally found in milk; it must be alkaline and sterile,* easily obtained, and its preparation not too complicated. It must as nearly as possible be of the composition of human milk and susceptible of modification to suit individual cases. Cow's milk is the most easily obtainable basis for modification. According to Meigs, the comparative average composition of human and cow's milk is:

	Human Milk.	Cow's Milk.
Water,	87.16	87.10
Fat,	4.28	4.20
Casein,	1.04	3.25
Sugar,	7.40	5.00
Salts,	0.10	0.52

Human milk is also alkaline and practically sterile, while cow's milk as it reaches the consumer is usually slightly acid and always contains bacteria. Other analyses give somewhat different results, but these may be taken as an average. Human milk differs in two important respects—it contains more sugar and markedly less proteid. The proteids of human milk are casein and lactalbumin, both not in solution but suspension, and capable of making a finely divided curd more readily digestible than that of cow's milk. Further, the proteid matter is of a different character. Fats are about the same. In some respects it is easy to make cow's milk conform to the standard. A sufficient amount of milk-sugar added makes this ingredient satisfactory, and the acidity can be corrected by the addition of lime-water. Brush and Jacobi maintain that cane-sugar is the ideal addition. Milk-sugar is rapidly changed into lactic acid. Sometimes it is borne well, at others not, because of the excess of lactic acid, which interferes with digestion. The presence of harmful bacteria must be prevented by care and cleanliness and their action may be overcome by sterilization. The regulation of fats and proteids is not so easy. A simple way is to dilute with water till the proteid is properly reduced and then add cream. When a fair trial has been given water as a diluent and vomiting of tough curds or their presence in the stools persists, barley or oatmeal water should be used to "split" the curds. Diluting milk with water does not prevent the formation of tough curds, but diluting

* Concerning the advisability of sterilization, it may be well to mention that children do not thrive well upon milk which has been subjected to a temperature of 212° F. for an hour and a half. The casein is made more firm and certain changes occur in the fat which tend to constipation. In the summer, when diarrheal diseases are prevalent, it may be of advantage to resort to sterilization when clean, fresh milk cannot be procured. Human milk obtained from 73 breasts of 64 nursing women, examined by Honigman with all aseptic precautions, contained Staphylococcus aureus or albus in all but four cases, the number varying from 1 to 9000 in a cubic millimeter, which seems to confirm the belief that micro-organisms are not necessarily prejudicial to health.

with gruels does prevent the hardening of the curds, as is proved experimentally and clinically. Barley water is used to prevent the formation of large curds by mechanical separation of the milk globules, but this is not always a good plan, because before the third month of life starch digestion practically does not exist on account of the lack of development of the pancreas. Whatever modified milk is used may be sterilized or pasteurized, if necessary, by keeping it at a temperature of 157° to 168° F. for twenty minutes. When boiled, the mixture is apt to cause constipation. The preparation of a modified milk can be undertaken without great trouble at home, but in the larger cities the matter may be left to certain laboratories, which may be depended upon to furnish an accurately modified food according to directions. The cost is considerable, however, and among the poor the plan is not feasible. In this case home modification is necessary. The principle on which milk is modified depends on the separation of the fatty portions in the cream, by standing or by centrifugalization; by these methods the cream and fats are separated to one part of the mass while the proteids and milk-sugar remain equally distributed throughout. By regulating the time of standing and selecting certain portions of the milk mass it is not difficult to select a specimen which contains any desired strength of cream. For example, a specimen standing six hours gives:

Upper $\frac{1}{5}$, ...	fat,	12.0 %	sugar,	4.4%	proteids,	3.78%.
Upper $\frac{1}{4}$, ...	"	10.0 %	"	4.5%	"	3.85%.
Lower $\frac{1}{4}$, ...	"	0.25%	"	4.5%	"	3.85%.

Longer standing increases the percentage of fats in the upper fifth.

In preparing modified milk it is necessary to work on a percentage basis entirely if good results are desired. Baner * has given a simple and on the whole satisfactory method of calculating the composition for any desired modification of milk for infants' use.

Q = the quantity in ounces for twenty-four hours. F = the desired percentage of fat. S = the desired percentage of sugar. P = the desired percentage of proteids. A = the desired percentage of alkalinity. C = cream; M = milk; L.W. = lime-water.

Cream, ... $\frac{Q}{\text{Percentage of fat in cream} - 4} \times (F - P)$.

Milk, ... $\frac{Q \times P}{4} - C$.

Lime-water, ... $\frac{A}{100} \times Q$.

Water, ... $Q - (C + M + L.W.)$.

Dry milk-sugar, ... $\frac{(S - P) \times Q}{100}$.

Example: If 40 ounces of a mixture containing 4 per cent. fat, 7 per cent. sugar, and 2 per cent. proteids is required, proceed as follows: Cream, $\frac{40 \times 2}{12 \text{ (quantity of cream used)}}$ gives $6\frac{2}{3}$ ounces. Milk, $\frac{40 \times 2}{4}$ minus $6\frac{2}{3}$ equals $13\frac{1}{3}$ ounces. Milk sugar, $\frac{40 \times 5}{100}$ equals 2 oz. Lime-water q. s. to make alkaline; plain water up to 40 ounces. Mix and divide into as many bottles as desired.

From this it is a simple matter to prepare the food, though it will from time to time be necessary to vary the proportions of some ingredients. The usual percentage of lime-water is five, but it is sometimes necessary to use ten or fifteen.

Winters † gives the formulæ on page 857 for the home modification of milk. I give these formulæ in full because they are the simplest and most explicit with which I am acquainted. A somewhat more gradual strengthening of the food during the summer months should be used than is indicated in these formulæ. As a rule, an infant of three or four months will not digest more

* "N. Y. Med. Jour.," Mar. 20, 1898.

† "The Feeding of Infants," Dutton & Co., New York, 1901.

FORMULÆ FOR THE HOME MODIFICATION OF MILK.—(*Winters.*)

Formula No. 1. For the First, Second, and Third Days.

Upper 1 ounce from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 0.8 ounce (about 3 tea-	Fat, ...2.00 per cent.
Lime-water, ... 1½ ounces spoonfuls)	Milk-sugar, .7.00 "
Filtered water, . 9 "	Proteids, ...0.25 "

Quantity at each feeding: First and second days, ½ ounce; third day, 1 ounce. Ten feedings, at 6–8–10–12 A.M., 2–4–6–8–12 P.M., 4 A.M.

Formula No. 2. For the 4th, 5th, 6th, and 7th Days.

Upper 1½ ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 1 ounce (about 4 tea-	Fat, ...2.50 per cent.
Lime-water, ... 2 ounces spoonfuls)	Milk-sugar, .7.00 "
Filtered water,..10½ "	Proteids, ...0.33 "

Quantity at each feeding: 1 ounce. Ten feedings as above.

Formula No. 3. For the Second Week.

Upper 2¼ ounces from a quart of milk 16 hours after milking.

	Composition.
Cream,..... 2¾ ounces	Fat, ...3.00 per cent.
Milk-sugar, ... 1 ounce (about 4 tea-	Milk-sugar, .7.00 "
Lime-water, ... 2 ounces spoonfuls)	Proteids, ...0.50 "
Filtered water, .10 "	

Quantity at each feeding: 1½ ounces. Ten feedings as above

Formula No. 4. For the Third Week.

Upper 6 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 1.8 ounces (about 5½ tea-	Fat, ...3.50 per cent.
Lime-water, ... 4 " spoonfuls)	Milk-sugar, .7.00 "
Filtered water, .18 "	Proteids, ...0.75 "

Quantity at each feeding: 2 ounces. Ten feedings as above.

Formula No. 5. For the Fourth to Eighth Week.

Upper 9 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 2 ounces (about 8 tea-	Fat, ...4.00 per cent.
Lime-water, ... 4 " spoonfuls)	Milk-sugar, .7.00 "
Filtered water, enough to make 1 quart	Proteids, ...1.00 "

Quantity at each feeding: 2½ ounces. Ten feedings as above.

Formula No. 6. For the Ninth to Twelfth Week.

Upper 11 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 1.9 ounces (about 7½ tea-	Fat, ...4.00 per cent.
Lime-water, ... 4 " spoonfuls)	Milk-sugar, .7.00 "
Filtered water, enough to make 1 quart	Proteids, ...1.25 "

Quantity at each feeding: 3 ounces. Eight feedings, at 6–8:30–11 A.M., 1:30–4–6:30–9–12 P.M.

Formula No. 7. For the Fourth Month.

Upper 13 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 1.8 ounces (about 7 tea-	Fat, ...4.00 per cent.
Lime-water, ... 4 " spoonfuls)	Milk-sugar, .7.00 "
Filtered water, enough to make 1 quart	Proteids, ...1.50 "

Quantity at each feeding: 3 to 4 ounces. Seven feedings, at 6–9–12 A.M., 3–6–9–12 P.M.

Formula No. 8. For the Fifth and Sixth Months Inclusive.

Upper 15 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 1.7 ounces (about 6⅔	Fat, ...4.00 per cent.
Lime-water, ... 4 " teaspoonfuls)	Milk-sugar, .7.00 "
Filtered water, enough to make 1 quart	Proteids, ...1.75 "

Quantity at each feeding: 5 to 6 ounces. Six feedings, at 6–9:30 A.M., 1–4:30–8–12 P.M.

Formula No. 9. For the Seventh, Eighth, and Ninth Months.

Upper 17 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ... 1.4 ounces (about 5½ tea-	Fat, ...4.00 per cent.
Lime-water, ... 4 " spoonfuls)	Milk-sugar, .6.50 "
Filtered water, enough to make 1 quart	Proteids, ...2.00 "

Formula No. 10. For the Tenth and Eleventh Months.

Upper 21 ounces from a quart of milk 16 hours after milking.

	Composition.
Milk-sugar, ...1.1 ounces (about 4½ tea-	Fat, ...4.00 per cent.
Lime-water, ...4 " spoonfuls)	Milk-sugar, .5.50 "
Filtered water, enough to make 1 quart	Proteids, ...3.00 "

than 1 per cent. of proteid during the hot weather. During this time also many of the digestive disturbances may be averted by increasing the proportion of lime-water to one-fourth of the total quantity of the mixture. The prepared mixture is placed in as many bottles as there are feedings for the twenty-four hours, each bottle containing the amount of one feeding; the bottles are then stopped with sterile absorbent cotton, placed in a refrigerator, and kept at a temperature of 45° to 50° F. until needed. The two unerring guides to the quantity of each feeding are the capacity of the infant stomach and the amount of milk secreted by the breasts of a healthy nursing woman. The following table, also from Winters, shows the proper quantity, number of feedings, and intervals for artificial feeding up to nine months:

TABULAR GUIDE FOR ARTIFICIAL FEEDING.

Age.	Quantity.	Number of Feedings.	Intervals.
1st, 2d, and 3d days,	½ ounce	10	2 hours
4th, 5th, 6th, and 7th days,	1 "	10	2 "
2d week,	1½ ounces.	10	2 "
3d week,	2 "	10	2 "
4th, 5th, and 6th weeks,	2½ "	10	2 "
7th, 8th, and 9th weeks,	3 "	8	2½ "
3d and 4th months,	3 to 4 "	7	3 "
5th to 9th months,	5 to 6 "	6	3½ "

For young infants, milk should not be added to cream. Milk and cream do not unite. If shaken together, and then allowed to stand for a short time, separation is complete. The same occurs in the stomach. The stomach has practically to cope with whole milk. Many failures are due to this prevalent error.

The following percentages and relative proportions of fat and proteid must be adhered to for successful feeding (Winters):

	Fat.	Proteid.
First three days,	2.00	0.25 per cent.
Succeeding days—first week,	2.50	0.33 "
Second week,	3.00	0.50 "
Third week,	3.50	0.75 "
Fourth to eighth weeks,	4.00	1.00 "
Ninth to twelfth weeks,	4.00	1.25 "
Fourth month,	4.00	1.50 "
Fifth and sixth months,	4.00	1.75 "
Seventh, eighth, and ninth months,	4.00	2.00 "
Tenth and eleventh months,	4.00	2.50 "
Twelfth month,	4.00	3.00 "

In summer the strengthening must be more gradual, as follows (Winters):

	Fat.	Proteid.
First week,	2.00	0.25 per cent.
Second week,	2.50	0.33 "
Third and fourth weeks,	3.00	0.50 "
Fifth and sixth weeks,	3.50	0.75 "
Seventh week to end of third month,	4.00	1.00 "
Fourth month,	4.00	1.25 "
Fifth and sixth months,	4.00	1.50 "
Seventh month,	4.00	1.75 "
Eighth and ninth months,	4.00	2.00 "

General Directions.—A certain amount of systematic preparation and a few articles in the way of apparatus are necessary for home modification and for the use of the modified milk after it is prepared. These are: two or three glass jars to set the milk in, fruit-jars will do, a glass siphon, a dairy thermometer, a graduated measure up to 8 ounces, and a number of 4-ounce and 8-ounce

bottles for feeding. A good supply of rubber nipples and plenty of sterilized cotton are necessary. A good-sized vessel for sterilization is also needed. All these articles are to be used sterile, and those which can stand it are subjected to boiling in a soda solution at frequent intervals. The same feeding-bottle should not be used at consecutive feedings and between times should lie in a soda solution. When the milk is received, it is allowed to stand in the sterile jars in a cool place as long as desired. The lower part may then be siphoned off and mixed in a sterile vessel with cream, lime-water, sterile water, and milk-sugar in

FIG. 994.—A GOOD TYPE OF RUBBER NIPPLE.

FIG. 995.—A GOOD TYPE OF FEEDING-BOTTLE.

the necessary proportions. The formulæ which have been given may be used. When sterilization is necessary, the modified milk may be placed in the feeding-bottles, the mouths of which are to be plugged with sterile cotton, and placed in a wire rack in the sterilizing dish and lowered into the water, the temperature of which is then slowly raised to 167° F. and kept there for twenty minutes. After this the bottles are to be kept cool till needed, when they are to be warmed in water to between 99° and 101° F., the proper temperature for infant food.

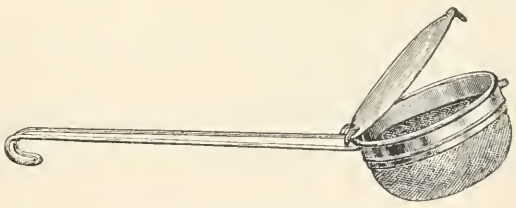


FIG. 996.—NIPPLE STERILIZER.

Not more than a day's supply of food should be prepared at a time. A complete outfit for the preparation of modified milk can be bought, but it is no more serviceable than are the articles mentioned. Whatever preparation is used, the greatest care as to cleanliness must be observed if good results are to be obtained. After each nursing, the bottle is rinsed in cold water which removes the particles of milk without coagulating them and then scalded; the nipple should be washed in cold water and both nipple and bottle kept in a soda solution to prevent acid fermentation. The short nipple only should be used, as

it is the only one which can be properly cleansed. While the child is feeding the bottle should be encased in a knitted bag to maintain the temperature as long as possible. The amount usually required at one nursing by a new-born child for the first week is one ounce, gradually increased till the sixth week, when it receives two and a half ounces, but the amount varies with the size of the child. The bottle should be held so that the child can suckle advantageously; that is, so that its mouth is directly opposite the summit of the nipple. Certain symptoms may point to the necessity of modifying the composition of the child's food; *e. g.*, if it regurgitates its food unchanged, it is getting too much, or the amount of fluid is too large; if it takes its food eagerly but seems continually hungry and does not gain in weight, the proportion of solids may be increased, which is accomplished by diminishing the water.

FIG. 997.—BOTTLE-BRUSH FOR CLEANSING FEEDING-BOTTLES.

4. Patented or Proprietary Foods.—There is one truth which by this time should be taken as an axiom—namely, that mother's milk is the most appropriate food to be taken by the infant in all stages of development and no patented infant food can even approximate it in value. The majority of such foods now on the market are either farinaceous, made from cereals and consisting largely of unconverted starch, or malted foods, also made from cereals but having the starch transformed into soluble maltose and dextrin. They vary in composition and strength, but as a class contain an excess of carbohydrates, little if any fat, and proteids which do not resemble those in mother's milk. Chittenden * analyzed certain proprietary foods according to directions for infants of six months, with the following results:

	FAT.	SUGAR.	PROTEID.	STARCH.	
Imperial granum,	1.54	2.71 milk	2.15	1.22	Reaction alkaline.
Nestlé's food,	0.36	0.84 "	0.81	1.99	"
		2.57 cane			
Malted milk,	0.68	1.18 milk	1.15		"
		3.28 maltose			
		0.92 dextrin			
Mellin's food,	2.89	3.25 milk	2.62		"
		2.20 maltose			
		0.53 dextrin			
Peptogenic milk powder,	4.38	7.26 milk	2.09		"
Condensed milk,†	1.70	6.00 cane	1.50		"
		2.26 milk			

INFANT'S WEIGHT.

First week	7 pounds	Fifth to sixth month	14 to 16 pounds
Second week	7 to 8 "	Seventh, eighth, and ninth month	16 to 18 "
Third week	8 to 9 "	Tenth to eleventh month	18 to 19 "
Fourth to eighth week	9 to 10 "	Twelfth month	19 to 20 "
Ninth to twelfth week	10 to 12 "		
Fourth month	12 to 14 "		

Open Air.—A baby can be taken into the open air when a month old in mild weather, and at about two months in winter. In southern climates it can of

* " N. Y. Med. Jour.," July 18, 1896.

† The percentages of condensed milk are those found in the Milkmaid brand, diluted with seven parts water.

course go out much earlier than in northern ones. Under proper conditions the more open-air life a baby can have, the better. As for exercise, it should be allowed to kick and roll about in its crib unhampered by long, clogging skirts; and to creep if it wishes, if there are no draughts near the floor. Walking belongs to a later period, from about the thirteenth month.

Sleep.—A very young infant will sleep about twenty-one hours of the twenty-four, and should be allowed to sleep and not be roused to be displayed to friends. It should never sleep in bed with the mother from danger of being overlaid and also because it is apt to be covered with the bedclothes and the fresh air kept from it. It should have a crib, not a rocking cradle, near the mother's bed, and should be laid there to sleep without previous handling or carrying about. Babies greatly prefer the delicate attentions of rocking and carrying, and are clever enough to insist upon having it if they have ever experienced it, wherefore it is for the peace of all concerned, as well as better for the baby's nervous system, not to accustom it to the luxury. Other habits may also be formed at a far earlier age than is usually supposed; I refer to the evacuation of the bladder and bowels.

Bladder and Bowels.—It is difficult to regulate the passing of water, but some nurses are successful in securing a certain amount of regularity by placing the babies upon a vessel soon after feeding. The bowels can almost invariably be trained to regularity by trying to secure a movement at the same hour every day. There will be as many as four a day for the first week, gradually diminishing till there are usually two a day after the sixth month. Sometimes there is only one, but provided that is abundant, soft, and yellow, not lumpy, it need cause no anxiety. Constipation is to be avoided as it is the cause of serious troubles and of future bad habits. Unceasing care must be exercised to secure a good movement at the same hour every day, and should the child show "a constipated habit," or have hard, painful stools, the condition of the food must be investigated. Some infants are constipated while nursing but become perfectly regular when put on solid diet. Constipation in the mother will have a great effect on the infant's bowels, and she cannot be too careful to keep herself regular and avoid sweets, starchy foods, cakes, pastries, and acids. In a bottle-fed child the milk is found frequently to be deficient in fats. Cream and water will then have to be added. As far as possible the use of drugs should be avoided and the desired end attained by a healthful mode of life for both mother and child, plenty of fresh air, exercise, a rational diet, loose clothing, quiet, calmness, and regular habits. Exercise may be given in the passive form to an infant by gently rubbing its abdomen with a circular motion. Diarrhea is more often due to overnursing and overfeeding and to drinking too little water than to other causes. The habit of putting the child to the breast every time it cries defeats its own end, for it is the best way to sow the seeds of colic, vomiting, diarrhea, and discomfort.

The Nursery.—When it is possible, let the nursery for the baby be a sunny room in which there is no plumbing and which can be well ventilated and easily heated. A board eight inches wide slipped under the whole length of the lower sash will allow of the entrance of air without draught, and a register, an open fire, or a stove with a pan of water always on top, should keep the temperature at about 70° or preferably 65° F. The temperature should not vary much from this during the night and the fresh air should not be excluded. Whatever the prejudice against night air, it is better than carbonic acid gas laden with impurities from the lungs, and such will be the air of a closed room in which sleep a child and a nurse. Cleanliness, simplicity, cheerfulness, should be the guiding

maxims in arranging a nursery. The fewer curtains, hangings, and carpets, the better, as they lodge bacteria. No soiled napkins should be allowed to stay in the room and vessels should be removed and cleaned as soon as used.

Environment.—Even in infancy it is well to preserve a calm environment for the baby. Noise, excitable actions and tones, and much prancing and dancing for the baby's entertainment should be avoided. Children suffer from too much attention in the line of amusement, and a little wholesome neglect in this respect will not only teach them to amuse themselves, but will induce calmer nerves and subsequent better health.

Weaning.—Weaning should occur between the ninth and fourteenth months, but some conditions may make it desirable earlier. It is better to have it a gradual than a sudden process, substituting a little bread and milk, hominy, or other cereal for one of the regular feedings.

Prepuce and Hood of Clitoris.—1. In male infants, beginning on the sixth or seventh day after birth, the nurse should be instructed to retract the prepuce daily, drawing it back a little every day until all adhesions are broken up, and the glans, as far as the corona, is exposed. It usually takes two or three daily attempts to expose the glans completely. Daily retraction should thereafter be practised by the nurse and all smegma removed with a saline, boric acid or very weak soap solution and clean absorbent cotton. To prevent the readhesion of the raw surfaces, the free application of sterile vaseline between the prepuce and glans I have usually found sufficient. Occasionally sterile gauze or cotton, placed just back of the corona, will be demanded for this purpose. The mother or child's nurse should subsequently be instructed to repeat the cleansing daily during infancy, and until the boy can be taught to attend to the matter himself.

Adhesions between the prepuce and glans penis are quite common, and are often causative factors of many reflex nervous affections and even convulsions.

In both private and hospital practice I insist that firm adhesions shall be promptly reported to me. In one of my services at the New York Maternity two cases of persistent infantile convulsions were promptly cured by circumcision. The above described "stripping" of the glans penis will in the newly born usually be found a simple procedure, and it is much preferable that it be done in infancy by the nurse or physician, than several years later by the boy of six or eight.

2. In my experience the nymphæ in female infants are rarely so firmly adherent to each other or to the labia majora as in the male is the prepuce to the glans. This statement is based upon several thousand observations. The hood of the clitoris can usually be readily drawn back, and the proper cleansing secured, but this is not so necessary as in the case of the prepuce.

PART NINE.

The Pathology of the Newly Born.

I. PATHOLOGY DUE TO INTERRUPTED PREGNANCY. PREMATURITY. (Page 800.)

II. AFFECTIONS OF ANTENATAL ORIGIN WHICH EXTEND INTO EXTRA-UTERINE LIFE. (Page 807.) 1. Malformations and Monstrosities. 2. Acute Infectious Diseases. 3. Chronic Infectious Diseases. 4. General Conditions. 5. Infantile Syphilis.

III. AFFECTIONS WHICH ORIGINATE INTRA PARTUM. (Page 812.) 1. Asphyxia Neonatorum. 2. Birth Traumatisms. 3. Aspiration Pneumonia. 4. Contagious Diseases Contracted from the Mother. (1) Ophthalmia Neonatorum. (2) Gonorrheal Stomatitis.

IV. DISEASES INCIDENT TO CHANGE OF ENVIRONMENT. (Page 837.) 1. Primary Asphyxia of the Newly Born. 2. Atelectasis Neonatorum. 3. Failure of Circulation. 4. Œdema Neonatorum. 5. Failure of Digestion and Assimilation. Inanition. 6. Inanition Fever.

V. DISEASES DUE TO BACTERIA AND FUNGI. (Page 840.) 1. Umbilical Sepsis. 2. Septic Coryza. 3. Septic Pneumonia. 4. Gastro-intestinal Sepsis. (1) Ulcerative Stomatitis. (2) Gangrenous Stomatitis. Noma. (3) Parotitis. (4) Retropharyngeal Abscess. (5) Gastro-enteritis. 5. Cutaneous Sepsis. (1) Dermatitis Exfoliativa (Ritter's Disease). (2) Pemphigus Acutus Neonatorum. Septic Pemphigus. (3) Impetigo Contagiosa Neonatorum. Periumbilical Pemphigus. (4) Ecthyma Neonatorum. (5) Multiple Abscess. (6) Erysipelas. 6. Tetanus. 7. Aphthæ. 8. Thrush.

VI. DISEASES OF UNKNOWN NATURE. (Page 847.) 1. Omphalorrhagia. 2. Melena. 3. Miscellaneous Hemorrhages. 4. Sclerema Neonatorum. 5. Buhl's Disease. 6. Winckel's Disease. 7. Mastitis. 8. Jaundice.

VII. GENERAL POST-PARTUM CONDITIONS. (Page 852.) 1. Ulceration of the Hard Palate. 2. Sublingual Cysts. 3. Vomiting. 4. Colic. 5. Diarrhea. 6. Constipation. 7. Intestinal Obstruction. 8. Pneumonia. 9. Convulsions. 10. Infantile Cachexia. 11. Sudden Death. 12. Medication of the Newly Born.

General Considerations.—While it is customary to assign particular causes for individual infantile deaths, the fact must remain that in the struggle for existence many fetuses and newly born children are simply unable to survive, and that the particular disease which terminates their existence is almost a matter of indifference as compared with the marked predisposition to early

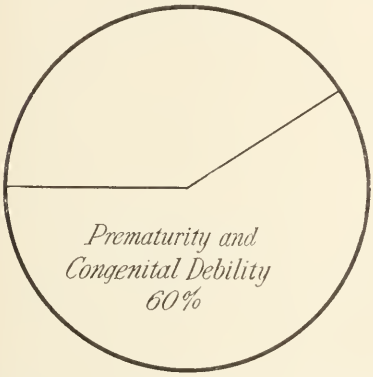


FIG. 998.—DIAGRAM SHOWING THE MORTALITY OF THE NEWLY BORN IN NEW YORK.—(*Modified from A. Brother's tables.*)

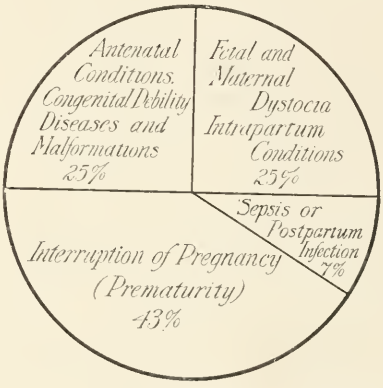


FIG. 999.—DIAGRAM SHOWING THE MORTALITY OF THE NEWLY BORN.

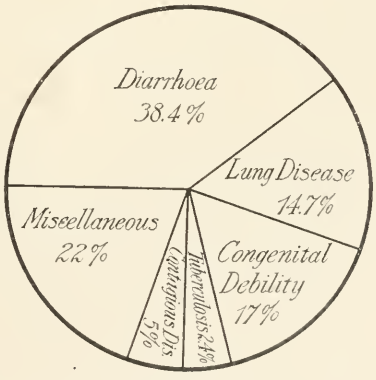


FIG. 1000.—DIAGRAM SHOWING THE MORTALITY OF INFANTS IN THE FIRST YEAR OF LIFE.—(*Budin.**)

death. Nevertheless, these various conditions of the fetus and newly born must be carefully considered, because many of them are not only capable of producing death independently of predisposition, but are doubtless largely preventable. In countries in which the birth-rate is falling off from unwillingness on the part of wedded couples to procreate, the rescue of the fetus and

* "L'Obstétrique," September 15, 1901.

newly born from some of these fatalities assumes tremendous importance. The pathology of the newly born comprises phases set forth above (Figs. 998, 999, 1000).

I. PATHOLOGY DUE TO INTERRUPTION OF PREGNANCY. PREMATURITY.

Introduction.—The premature expulsion of the contents of the uterus is necessarily fatal before a certain period at which the fetus becomes viable, and is known as abortion and miscarriage. On the other hand, interruption very shortly before term need not compromise the child's existence. Between these limits the fate of the infant is problematical. It is, of course, difficult to fix precisely the age for survival of the child. In some statistics the mortality of these premature children is excessive; in others the death-rate is relatively low. Generally speaking, "prematurity" is an unscientific term; for death, whether *in utero* or after delivery, must have some cause, and prematurity is only a predisposition. No distinction can be made in practice between prematurity and congenital debility, and the exciting cause of death should be sought for. But while the exact cause of death should be determined in each case, no one, of course, denies that true prematurity is a most common and potent cause of stillbirth and infantile death, and that it affords a predisposition for the action of all other pernicious elements. The further removed the labor from term, the greater the influence of the predisposition (Figs. 998, 999, 1000).

Definition.—Prematurity might be defined as the act or state of being born before term. A very brief study of modern obstetrical teaching will convince one that this subject has never received due consideration. Premature children are usually regarded as constituting a large share of those congenitally weak infants who require special care at birth. One does not find in obstetric writings any sharp line of demarcation between weak premature and weak mature infants, at least from the practical point of view. Nevertheless prematurity should constitute a particular field in obstetrics and should receive adequate consideration from all points of view.

Percentage of Premature Births.—The actual percentage of premature children varies within wide limits. In the Rotunda Hospital, Dublin, the number of premature births is but 1 or 2 per cent. On the other hand, Braun, of Vienna, claims that his proportion of prematurity cases amounts to over 35 per cent. of all births. Numerous observers report a percentage about half-way between these figures, and the average of ten large clinics in various parts of the world is about 17.50 per cent., which must therefore be accepted as final. In other words, one birth out of six, the world over, is probably premature. The great variability in different clinics and in the same clinic in different years is as yet inexplicable. The discrepancy in the death-rate in different clinics matches that of the birth-rate. In the English vital statistics 13 per cent. of the mortality of the first year of life is due to prematurity. The rate in the Paris Maternity is about 20 per cent. Rosthorn reports a death-rate of but 1 per cent., Ahlfeld of 2 per cent., Hofmeier of less than 3 per cent. On the other hand, Winckel's figures are 11.5 per cent., and the mortality in certain clinics runs up to 30 per cent., while a few go beyond this limit, and even one as high as 50 per cent. Murillo, of Santiago, Chili, has kept records for a number of consecutive years, and his death-rate from prematurity varies from 5 to 10 per cent. As far as may be determined, the mortality of prematurity will average something like 20 per cent., the individual variation and general average being much the same as those of the birth-rate.

Etiology.—Prematurity is not solely a matter of chronology, for the development of the fetus does not necessarily keep pace with the calendar. A child may be born at term and yet be backward in development; and, conversely, children may be born before term and yet be fully mature. Prematurity, therefore, is an

ambiguous term which may refer alike to the date of labor and the state of development of the child. Such ambiguity should not exist, and terms should be introduced to distinguish between these two ideas. Of these two conceptions of maturity, the merely chronological phase should be regarded as incidental, while the element of the state of development of the fetus at birth should be regarded as essential.

Symptoms.—The objective qualities of a premature child are well known and tolerably constant. As compared with a mature child, the premature infant presents a bright red color with a small quantity of vernix caseosa; there is a dearth of subcutaneous fat, so that the skin hangs in folds. The child is somnolent, has a weak cry, limp muscles, and shallow breathing. Sucking and swallowing are performed with difficulty. The eyes are closed. In regard to relative dimensions, the head is larger in proportion to the body than in maturity and the belly is more prominent. A still closer investigation of the premature child shows a number of minor peculiarities. The head is compressible, the sutures and fontanelles being wide open, and asymmetry may result from compression in one portion. The ears lie flat against the head. The skin is very delicate, showing the subcutaneous veins, and is covered uniformly with lanugo. The nails are soft and do not extend to the ends of the fingers. From the twentieth to the twenty-fourth week the lanugo and vernix caseosa first appear; the scalp hair has become differentiated. In the male the scrotum is small, and as yet empty, while in the female the labia majora are separated by the clitoris. The surface of the child is bright red. Children born at this period can move and breathe. From the twenty-fourth to the twenty-eighth week subcutaneous fat begins to appear in the region of the neck, shoulders, and breast. The nails are represented only by firm folds of integument. Children born during this period are able to cry softly. From the twenty-eighth to the thirty-second week the pupillary membrane disappears, the intense red color fades out, the subcutaneous fat becomes diffused over the body, and the nails are developed nearly as far as the finger-tips. Children born during this period are viable. From the thirty-second to the thirty-sixth week the child resembles a mature infant, the differences being of degree only. Thus, there is less subcutaneous fat present, so that the skin is somewhat wrinkled; the cranial bones are more pliable, the nails are shorter and less firm, and the lanugo is more abundant. The scrotum of a male child born at this period exhibits wrinkles and folds. (Compare pages 85 and 86.)

Physiological Peculiarities.—The premature child has physiological as well as anatomical peculiarities. In heat-making power it is defective, doubtless because of its imperfect respiration, and the temperature constantly fluctuates by reason of the defective action of the heat-regulating mechanism or instability of the respiratory center. The thorax is somewhat inelastic and the lungs are prone to atelectasis. Respiration is carried on only by the anterior portion of the lungs. The premature child does not regain its initial loss of weight for a month. Naturally these infants are ill fitted to sustain the traumatisms of labor, where the compression favors congestion and hemorrhage. I have often noted the frequency of ecchymoses in breech deliveries of the premature. Interstitial hemorrhage into the nervous centers is doubtless favored, with production of athetosis and cerebral diplegia. In addition to the natural inability to nurse, the contact of the rubber nipple or teaspoon, as well as the operation of gavage, is a source of dangerous irritation. The premature child is especially liable to hernia, both inguinal and umbilical, because its orifices are insufficiently closed. The descent of the testicle also favors inguinal hernia.

The first attempts at respiration may provoke fatal paroxysms of cyanosis. While some authorities mention a "premature" quality of pulse and respiration, a pulse of 140 and respiration of 40 to 60 are not incompatible with perfect health. Anuria is sometimes seen in the premature. Determination of the age of the fetus by the calendar is at best very difficult, for obvious reasons. Practical obstetrics recognizes no distinction in congenitally feeble children independent of the date of birth. It is better, I believe, to do away with the element of time in these cases and to be guided solely by the state of development of the child. At the same time, however, in the matter of artificially induced premature delivery, we have to rely largely upon the calendar, because we have no means by which we may be able to estimate the degree of development of the child *in utero*. The newly developed science of external cephalometry, as practised to-day in Paris, may possibly become effective in determining the degree of development through intrauterine mensuration of the head. (Compare page 180.) At present the real criterion of maturity is the development of the child at birth. Of the various criteria proposed, some authorities prefer the temperature; others, the dimensions and weight. Eröss, of Budapest, made 1150 measurements in 50 premature children. Of them, 19 had normal temperature, 18 hyperthermia (due to some febrile complication), while in the remaining 13 the temperature was subnormal. To estimate the degree of prematurity or debility we must consider (1) age (development), (2) weight, (3) temperature. Budin regards every newly born infant with a rectal temperature of not more than 90° F. (32° C.) as a candidate for the incubator. Some would regard all children as congenitally feeble whose weight does not exceed 4.37 pounds (2000 grams); others make the limit 5½ pounds (2500 grams). In regard to the causes of congenital debility, we find children born at term who are nevertheless premature in development when the mother suffered during gestation from anemia, hyperemesis, and cancerous cachexia. At the same time very poorly nourished women may bear fine children.

Prognosis.—The prognosis varies with the degree of prematurity and the development of the infant. A child born but a few weeks before full term, with a vigorous cry, circulation well established, and capable of taking nourishment, will require scarcely more attention than a full-term baby, but, as a rule, in premature infants the problem of feeding and maintaining the animal heat is not easy to solve. Premature infants or those inherently delicate require the utmost care and attention. Only a small proportion of children born before the seventh month survive, but after the seventh month, the recognized period of viability, the percentage of infants saved varies from 50 to 96. The nearer full term, the greater the child's chances of life.

Treatment.—There are three main principles in the treatment of prematurity: (1) The temperature immediately surrounding the child should be such as is adapted to its requirements; (2) its nutrition should be maintained by proper feeding; (3) the amount of handling or other disturbance should be reduced to a minimum.

Management at Birth.—The temperature of the lying-in room should be carefully regulated and the child should be handled with the greatest care from the moment of birth. The rule that the cord should not be ligated until it has ceased pulsating is here obviously of special importance. Meanwhile the child should be wrapped in warm blankets. As soon as the cord is ligated the child should be thoroughly wrapped in warm cotton batting, the face only being uncovered. It should then be wrapped in warm blankets and transferred to the incubator. If artificial respiration is necessary, those methods which

involve the most rough handling and exposure to cold should be avoided if possible. (See page 819.)

Bathing; Dressing.—Premature children should not be bathed, but may be cleansed as becomes necessary with a soft cloth and warm sweet oil. The action of the skin may be improved by anointing the body every two or three days with the same material. All handling not absolutely necessary should be prohibited. The child enveloped in warm cotton batting or in the heated air of the incubator needs no clothing except a diaper, and should have none, since even the passive movements necessary in dressing are somewhat of a shock to these feeble children. Absorbent cotton, which may be used and thrown away as required, should be preferred to the ordinary diaper. Chafing should be carefully guarded against.

Alimentation.—Ordinarily the weakened condition of the infant precludes the possibility of nursing or of taking the proper amount of nourishment from a bottle. Feeding with a small medicine-dropper, at intervals of one or two hours, is advised. The amount given at each feeding depends on the capacity of the infant. One-half ounce is a proper amount to begin with. In many cases, however, gavage, or forced feeding,—described elsewhere,—is indispensable. Breast-milk from a woman having a child between two or three weeks and several months old is the best form of nourishment, and when given makes the prognosis decidedly better. Equal parts of a sugar solution should be added to the breast-milk. Cow's milk is employed only when it is impossible to obtain breast-milk, and then in weak proportions. I have used modifications containing fat, 0.5 to 1; sugar, 4.0 to 8.0; and proteids, 0.25 to 0.75 with success. The amount and frequency of such feedings are increased as the infant's nutrition warrants. Plain sterile water should be given freely; it adds to the body-weight and helps elimination through the skin, bowels, and kidneys. These children must be fed in proportion to their weight, which may not exceed 4 pounds (1800 grams). They must be fed promptly after birth; insufficient nourishment is shown by cyanosis, almost inevitably a fatal prognostic symptom. Budin sought to determine the stomach capacities of these children by autopsies upon fetuses of different uterine ages, and quite recently Planchon * has proceeded with a similar aim in a different fashion. While Budin experimented with the cadaveric stomach, Planchon's work has been done upon the living subject. An account was taken of the quantity of milk ingested, whether from the breast or by gavage, spoon-feeding or drinking from a glass. It was ascertained that the amount of milk increased with each day, and the heavier the child, the greater the amount of milk taken.

Gavage.—In the treatment of premature and congenitally weak infants, it is necessary at times to resort to gavage or forced feeding, by which is meant the introduction through a tube of food into the stomach (Fig. 1002). A small funnel of rubber or glass, two feet of rubber tubing, a No. 7 French scale rubber catheter, and a small glass tube three inches long to connect the tubing with the catheter, are required—practically the same apparatus used in stomach washing. When gavage is to be performed, the infant should lie flat on its back in the arms of a nurse, its arms held at the sides, and the head steadied by an assistant. The catheter is then quickly passed into the stomach and the food poured into the funnel, which is raised. As soon as the funnel is empty the catheter is withdrawn, pinching it to prevent the escape of any fluid into the pharynx. In very young infants the jaws can readily be separated by the fingers of the operator; in older children a mouth-gag may be required.

* "L'Obstétrique," 1901, vi, No. 5.

If the food is regurgitated, the process should be repeated. After feeding the child should be kept as quiet as possible. The children nourished in this manner should be fed at longer intervals than those suited to other conditions, the length

FIG. 1001.—THE OPERATION OF STOMACH WASHING (LAVAGE). For forced feeding (gavage) the infant is placed flat on its back (Fig. 1002). The same apparatus is used in both procedures, and both operations are valuable in the treatment of premature and congenitally weak infants.

of the interval being determined by the requirements in each case. It is a good plan to wash the stomach before the first feeding of the day (Fig. 1001). Gavage is more largely used in the treatment of premature infants kept in incubators,

but it is also indicated after operations on the nose and throat and about the neck, and in habitual vomiting. Food given by a tube often remains in the stomach when other methods of feeding are followed by vomiting. In certain serious conditions, such as pneumonia, diphtheria, and scarlet fever, the life of the child may depend upon gavage. In cases in which disease of the mouth, spasm of the muscles of the jaws, or intubation renders swallowing difficult or impossible, nasal feeding is resorted to. A soft-rubber catheter lubricated with vaselin or glycerin is gently pushed into the nostril, through the pharynx into the esophagus and stomach, and the feeding accomplished as described above. Stimulants and other medicines may be given by these methods.

INCUBATION.—*History:* According to Baumm,* the first incubator was devised by Denucé, of Bordeaux, in 1857. Credé's apparatus dates from 1864, and served as a model for many years. In 1880 Winckel introduced his permanent water-bath to the profession, but it proved cumbersome. Tarnier's incubator dates from the same

FIG. 1002.—THE OPERATION OF FORCED FEEDING OR GAVAGE.

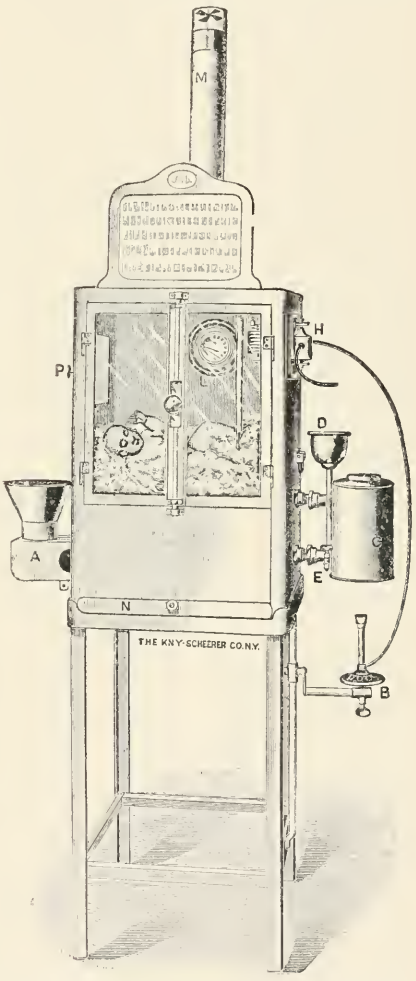


FIG. 1003.—A GOOD TYPE OF INCUBATOR OR COUVEUSE. (LION PATTERN.)

period. Quite recently numerous improvements have been added to the older incubators and new designs have been introduced. At present the well-known "Lion couveuse" takes precedence over all others. It is self-regulating within two degrees (Fig. 1003). In the absence of an incubator, or until one can be procured in private practice, the application of artificial heat may be carried out by swaddling the infant in raw cotton, head and all, leaving

* "Allgem. med. Ztg.," April 4, 1900.

only the face exposed, wrapping it about with a blanket and tying it around with a roller bandage. Hot bottles should be placed on each side of it. A very convenient method is to place the infant in a baby's basket half-full of raw cotton in which numerous hot bottles have been placed. The only other covering is a diaper and a shirt. The temperature of the room should be comfortably warm, particularly when the infant is stripped for a rubbing with oil. When these means fail to meet the indications, an incubator must be employed.* *Action:* When a child is placed in the incubator, its pulse and respiration are slightly accelerated, returning to the normal toward the sixth day, save that the respiration still remains slightly increased. The peripheral temperature is increased to a higher degree in the axilla than in the rectum. *Proper temperature:* It may vary from 86° to 98.6° F. (30° to 37° C.) according to the circumstances. Tarnier thought the average should be about 90° F. (32° C.), Pinard 93° F. (34° C.), while Colrat claimed that a higher temperature than 86° F. (30° C.) was discomforting to the child. Bonnaire obtained good results at 90° F. (32° C.). This temperature, 90° F., I have found to be satisfactory, although as high as 95° F. (35° C.) is occasionally required. Whatever the initial temperature, it should gradually be diminished, and it should descend to 77° F. (25° C.) before the child is withdrawn from the incubator. *Dangers:* The incubator is not unanimously recommended for prematurity. Serious objections are found to its use. The trouble with the premature child is a lack of thermogenic power, rather than superradiation. Hence, the incubator is essentially meddlesome and possibly contraindicated. The air of the incubator necessarily becomes foul, but this is somewhat offset by the method of construction of the latest models. The sudden change of the child's temperature when it is taken from the incubator to be bathed, etc., has never been shown to be prejudicial, despite the views of theorists. The possibility of the transmission of disease by the apparatus must receive the most serious consideration, and constitutes a weighty contraindication to its employment. The danger here is twofold, for the child may not only contaminate itself from a putrefying cord or feces, but the incubator serves well for the incubation and maintenance of germs which may infect the next child destined to occupy the apparatus. The problem of ventilation has not yet been solved. Most modern incubators are entirely too small for the amount of air required by the child. There is a serious danger in the possibility of suffocation in connection with vomiting, and to avoid this, constant supervision is necessary. In a case of Wormser's a child choked to death, milk coagula having been found in the bronchi. The closed incubator made it impossible to hear the warning cough of the child, which should have been kept out of the incubator for some time after feeding. Baumm's studies with the "Lion couveuse" gave the following results: At 98.6° F. (37° C.) 200 cubic inches (3300 c.c.) of air are admitted every second, which means that the entire air of the couveuse is renewed every minute. This amount is fully sufficient for all demands. A child which has been in the incubator two hours shows in the waste air a gain of carbonic acid amounting to but 0.16 per thousand, showing that the purification of the air of the incubator has been very complete. As to the children suited for the incubator, there is no necessary relationship between weight and vigor on the one hand, and production of heat on the other. A child which has subnormal temperature and cannot be kept warm by packing should go to the incubator.

* The Lion Incubator may now be rented in New York city from The Kny-Scheerer Co., 225 Fourth Avenue, New York, at a cost of $5.00 for installation, $5.00 for removal, and 50 cents per day for rental.

Duration of Treatment.—The child should be fed till it is able to nurse without exhaustion. Seven months' children will probably need to be fed for weeks, while those of eight months may be able to nurse. The duration of the child's stay in the incubator will vary with its progress and development. It may not be necessary to keep it there till full term. Attempts at discontinuing the treatment should be cautious and tentative. The temperature of the apparatus should be lowered gradually. As the child grows stronger, it may be taught to nurse by feeding it through a nipple shield, which should be perfectly clean.*

II. AFFECTIONS OF ANTENATAL ORIGIN WHICH EXTEND INTO EXTRAUTERINE LIFE.

1. Malformations and Monstrosities. 2. Acute Infectious Diseases. 3. Chronic Infectious Diseases. 4. General Conditions. 5. Infantile Syphilis.

It has already been stated in the section upon this subject that the fetus may be attacked *in utero* by a number of conditions, many of which render its survival impossible (pages 242 and 255). If the pernicious influences are exerted during the embryonal period, certain malformations and monstrosities arise, some of which are compatible with survival. During the fetal period pathogenic influences produce alterations more like those seen in extrauterine life. But aside from definite diseases, it is probable that in many toxic or cachectic states of the mother the fetus undergoes a sort of arrest of development or stunting, so that it presents many of the phenomena of prematurity. No distinction is possible between a condition which breaks out *in utero* and one which appears just after delivery. It is certain that the agencies which produce the disease act *in utero*, and if their action is exerted very late in pregnancy, or if it superinduce labor, the manifestations of the disease will occur post partum. An antenatal affection may run its course before delivery takes place; or may begin before birth and complete its cycle post partum; or, finally, may be contracted before labor, but manifested only afterward.

1. Malformations and Monstrosities.—The various congenital malformations and monstrosities have been noted elsewhere (Part III). Of the lesser monsters, some are compatible with survival (harelip, exstrophy of the bladder, etc.); some naturally incompatible with survival are amenable to treatment (imperforate rectum, etc.), while others, likewise incompatible with survival, are also beyond the resources of treatment; *e. g.*, imperforate esophagus. Of the major monstrosities, many cases of teratomelus are capable of survival (phocomelus [Fig. 353], etc.), but other single monsters can live only when the malformation is very slight, as in the first degree of cyclopia.

* *Statistical.*—In 1900 Berend and Deutsch ("Arch. f. Kinderheilkunde," xxviii, 1900) addressed 170 letters of inquiry to the chiefs of maternities in Europe and America in regard to congenital debility. They received about thirty-six replies, the most satisfactory of which were from Würzburg, Prague, Bologna, and Dublin. The circular letter referred to comprised eight queries, viz.: (1) What percentage of new-born children are premature? (2) What is the mortality of the new-born? (3) Is the incubator used? (4) Is it disinfected? (5) What is the average number of days spent in the incubator? (6) Has the incubator lessened the mortality among the premature? (7) If no incubator is used, what replaces it? (8) What is the mode of feeding? In regard to the use of the incubator 32 answers from clinics were received by Berend and Deutsch. It appears that but three institutions use the Lion couveuse; 11 the Tarnier-Auvard apparatus; 7 the Credé apparatus; while in the other 11 the old custom of wrapping the children in cotton still obtains. In regard to the temperature of the incubator, "it should vary inversely with that of the child."

2. Acute Infectious Diseases.—Children have been born with a full variolous eruption, or the exanthem may not appear until several days post partum. Such cases occur very infrequently. The child dies as a rule, but recovery has been recorded. Both *variola* and *vaccinia* of the mother may confer im-

FIG. 1004.—LARGE UMBILICAL HERNIA IN THE NEWLY BORN CONTAINING A PORTION OF THE INTESTINES, LIVER, STOMACH, AND SPLEEN.—(*Author's case.*)

munity against smallpox on children who have escaped actual infection *in utero*, but such immunity is short-lived. In the recorded cases of *measles* the children have always been born with full rash, the disease apparently exploding in the mother and fetus at the same time. It is otherwise with *scarlatina*, which in some cases has not broken out in the child until the first day post partum. In a few cases the newly born have been healthy at first, but contracted the maternal disease secondarily, probably from the breast-milk. No case of intrauterine transmission of *diphtheria* is known, but the newly born have been infected through other channels when the mother was suffering from the disease. The children born of women with *typhoid fever* exhibit a high degree of congenital debility and often succumb. The same is true of the children of *malarious* mothers who also show at times positive evidences of the disease itself (congenitally enlarged spleen, etc.). Children may, of course, be bitten soon after delivery by infected mosquitos, and, generally speaking, malaria may from one cause or

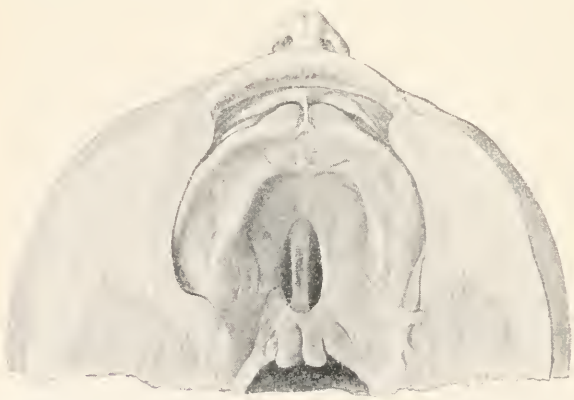


FIG. 1005.—CONGENITAL BILATERAL FISSURE OF THE HARD PALATE, CLEFT SOFT PALATE, AND SLIGHT DEGREE OF HARE-LIP.—(*Author's case.*)

another be encountered in the newly born of highly malarious districts. It presents but little difference from the type found in older individuals. Children have been born with the evidences of *influenza*. In regard to *sepsis* of the newly born which has been contracted *in utero*, children have been born with a septic form of pneumonia, and it is supposed that some of them survive this experience, although this is only an inference. Children have been born of rheumatic mothers with all the phenomena of *acute rheumatism*. For further information upon this and analogous affections, see Antenatal Diseases, page 255.

3. Chronic Infectious Diseases.—In a very few cases of actual congenital *tuberculosis* the children were born tuberculous, succumbing to the disease within a short time. The offspring of tuberculous mothers, while almost invariably free from tuberculosis, exhibit a high degree of congenital debility and perish readily from secondary mortality. It is not unlikely that some of the children of the tuberculous are born with the virulent bacilli in their tissues and are doomed to be infected perhaps forthwith, perhaps not until adolescence. If fetal *syphilis* does not prove fatal *in utero*,—a rare exception to the general rule,—the child, in addition to the visceral lesions already described (page 259), presents certain phenomena which are due evidently to failure in adjusting itself to the new surroundings. Such infants can survive but a short time, and their condition is known as syphilis neonatorum, to distinguish it from syphilis contracted *in utero*, which does not manifest itself until a month or thereabouts after delivery. This latter type, being extremely common, is the familiar infantile or congenital syphilis. A peculiarity of syphilis of the newly born is the general tendency to hemorrhage. The characteristic lesions of this phase of syphilis comprise bullæ which may exceptionally begin *in utero*, but as a rule tend to appear soon after birth. Their seat of predilection is the palms and soles, and they should not be confounded with septic pemphigus of the newly born (Fig. 1006). These bullæ have a hemorrhagic tendency, and the same disposition to bleed found in most of the tissues of the body constitutes a sort of scorbutus of syphilitic origin. Aside from the bullæ and general hemorrhagic diathesis, these children may present all the lesions described under the head of fetal syphilis.

4. General Conditions.—Chronic *metal poisoning* of the mother, *alcoholism*, *nicotinism*, *diabetes*, *albuminuria* and *eclampsia*, and the *cancerous cachexia* all tend to the production of weak, undersized fetuses with a high degree of secondary mortality. *Lead-poisoning*, *alcoholism*, and *albuminuria* also tend specially to cause convulsions and bestow a highly neuropathic organization upon the child. The offspring of the highly *neurotic*, *hysterical*, *epileptic*, and *psychopathic* individual also develop these tendencies, but here it is an affair of pure heredity. Children who appear normal at birth but develop tendencies in later life are not included under the pathology of the newly born. Ballantyne, for the same reason, does not describe hereditary chorea, hereditary ataxia, Thomsen's disease, etc., under affections of the newly born. In regard to the various local diseases which develop *in utero*, survival is largely a matter of accident. In *fetal ichthyosis* of the grave type, for example, one victim of the disease lived to the age of five months. Children with *fetal anasarca* have lived at most but a few days after birth. An infant with *congenital cystic elephantiasis* is known to have survived for twenty months. These are mere curiosities of medicine, for as a general rule children with the aforesaid affections are practically still-born, living at most but a few minutes. The condition known as *simple congenital elephantiasis*, characterized by overgrowth of the soft parts of a limb, is entirely compatible with life. The same is true of the mild form

of ichthyosis. Other congenital affections in which survival readily occurs are keratolysis, tylosis, anomalies of the pilous system, etc. The conditions comprised under the term *fetal rickets* are not incompatible with life. Children born with *ascites* seldom survive, but this is due principally to the relative impossibility of birth without mutilation. At least one case has shown that this affection is not *per se* incompatible with life. In *peritonitis*, as distinguished from ascites, a brief extrauterine existence has been recorded. In congenital *obliteration of the bile-ducts* the children may survive for a longer or shorter interval, but the prognosis is almost hopeless, and the same is true of congenital hypertrophic *stenosis of the pylorus*. in which three months is considered the limit of life. In *fetal endocarditis* there is an indefinite period of survival with occasional recovery. *Nephritis* contracted apparently *in utero* proves fatal within a short time after delivery; one infant lived twenty-one days. If the degree of *hydrocephalus* is not too extensive to prevent birth alive, or if the disease is just beginning, the patients may survive for some years. It is evident that the group of diseases of intrauterine origin which persist into extrauterine existence is not one of great importance. The most important is *hydrocephalus*, which, while of intrauterine origin, persists as one of the most important diseases of infancy. *Congenital debility*, characterized by small size and low weight, evidences of prematurity, subnormal temperature, etc., while not a disease, is a very common and important legacy of the antenatal period which may arise from a host of maternal conditions and which may predispose the individual to an early death under a variety of forms.

FIG. 1006.—SYPHILITIC PEMPHIGUS IN THE NEWLY BORN.—(*Lepage.*)

5. Infantile Syphilis.—Syphilis in infants is either congenital or a postnatal infection. (See Antenatal Syphilis, page 259.) In the first instance it is hereditary; in the second, an acquired disease with initial lesion and its sequences, which do not differ from those of later life except in the modifications which fetal tissue may bring about. Heredity is seen following syphilis of one or both parents. Infection from the father is most frequent and least severe, because influence ceases with impregnation. It is most depressing in double heredity, but maternal cases, owing to the nine months of interchange between the fluids of the fetus and the mother, show a mortality almost as high. According to Fournier's statistics of five hundred cases, one-third are fatal from transmission from the father, 60 per cent. from the mother, and 68 per cent. in mixed descent. These figures are very materially modified by prompt treatment. For pathology and symptoms, see Antenatal Syphilis, Part III.

Diagnosis.—To aid in the diagnosis of early inherited syphilis, there may be a history of disease or evident efflorescence in one or both parents, or the tale of repeated abortion may be elicited at progressively retarded periods, the fetuses being macerated, shriveled, with enlarged, lobulated livers, skin eruptions, or hydrocephalus. The infant presents signs of the disease at birth or they develop in a few days. It may be rosy and well nourished, but is oftenest emaciated, gray

in hue, with a senile facies. The palms and soles show red areas on which bullæ develop, moist papules are seen around the anus and mouth, the mouth is filled with sores. The baby has difficulty in nursing, breathes through the mouth, and snuffles continually. The cry is feeble and hoarse; there may be a persistent bronchitis. The eyes present no symptoms or there are a ciliary injection and photophobia. The end of one or more of the long bones shows an inflammatory

FIG. 1007.—SYPHILITIC OSTEOCHONDRITIS IN THE NEWLY BORN. LONGITUDINAL SECTION. × 100.—(*From a specimen in the Pathological Laboratory of the Cornell University Medical College.*)

enlargement. All symptoms may be absent when a parent is known to be syphilitic. The child must then be watched for developments (Fig. 1006).

Prognosis.—This is practically entirely dependent on treatment if the child is viable. Mortality in maternal descent is reduced from 60 to 3 per cent. Recurrence is unfortunately apt to occur, and in the shape of destructive lesions later in life, but the large percentage of relapses is due to insufficient medication

at the outset. Certain cases succumb to marasmus in spite of all that can be done. As to the viability of a fetus, the prognosis is better as the parental syphilis increases in age and as attention has been paid to treatment. Much can be done in the way of prevention by careful mercurialization of the mother during pregnancy.

Treatment.—Inunction should be instituted as soon as the diagnosis is made. It is best done by smearing mercurial ointment under the belly-band, where the child's movements will cause its absorption. The white precipitate or blue ointment may be used, a half-drachm of either, mixed with an equal part of lanolin, daily until the symptoms have disappeared, then every other day for a month. After that time the inunctions are continued with intermissions for a year, or internal medication in the form of gray powder or the protiodid or tannate may be substituted. It is well while mercury is being given systematically to administer a little iron from time to time in the shape of the syrup of the iodid. It is not enough to medicate the mother. The method is inaccurate and most unscientific, but there is small hope for the child if she does not nurse it. Wet-nursing is not to be considered on account of contagion, unless the nurse is syphilitic. Medication should be continued for at least a year, but the child should be kept under observation for two years.

III. AFFECTIONS WHICH ORIGINATE INTRA PARTUM.

1. Asphyxia Neonatorum. 2. Birth Traumatisms. 3. Aspiration Pneumonia. 4. Contagious Diseases Contracted from the Mother. (1) Ophthalmia Neonatorum. (2) Gonorrheal Stomatitis.

Here belong most of the cases of asphyxia, the various birth traumatisms, aspiration pneumonia, and contagious diseases—chiefly gonorrhea—contracted from the mother *sub partu.* So-called intranatal affections constitute a well-defined group which in general bears little relation to antenatal or neonatal disease. Some confusion may occur in the case of sepsis, which may be contracted at any period of existence, whether intrauterine or extrauterine. The pathogenic factors which operate intra partum may be mechanical or bacterial. The former consist largely of compression of the fetus, either by the maternal passages or by the forceps, and of traction by the medical attendant or of aspiration by the fetus of liquor amnii. The latter comprise a number of germ infections, one of which, however, stands out with prominence over all others: viz., *gonorrheal ophthalmia.* The mechanical element is equivalent to the entire subject of dystocia. The immediate results of mechanical compression may be general or local. There are but two examples of the general character. (1) *Asphyxia:* Here the compression is of such a character that the aeration of the fetal blood becomes arrested. (2) *Apoplexy:* Compression of the skull sometimes leads to endocranial hemorrhage, which may cause the death of the fetus, or, if the latter survives, paralysis.

1. ASPHYXIA NEONATORUM.

Synonyms: Apnœa neonatorum; asphyxia nascentium.

Introduction.—This subject, at first sight one of great simplicity, is in reality one of the most difficult in the entire subject of obstetrics. The simple and straightforward manner in which it is presented by the great majority of authors

involves a discreet suppression of numerous problems which would otherwise confuse and perplex the student. Nevertheless I deem it the wiser plan to face these difficulties and to attempt, at least, to distinguish between what is clear and what is obscure. Asphyxia neonatorum is one of the neglected connecting links between two specialties—obstetrics and pediatrics. Each one of these has apparently been perfectly willing to abandon its care of this subject to the other; each has considered it in a fragmentary way. The result has been that important phases of the subject still await investigation and our knowledge of it is imperfect.

Definition.—Before a definition can be made it will be necessary to analyze the meaning of the terms in use. What is meant by asphyxia, whether the word is used in a general sense or refers only to the newly born, is practically defective aeration of the blood, and this deficiency may be slight or extreme. While I do not advise the doing away with a term so universally employed as asphyxia, I prefer, when possible, to substitute some such expression as "subaeration." The term apnea, which has been proposed as a substitute for asphyxia, is open to the same objection as the latter word, and Ahlfeld has suggested that it be used to represent the physiological inactivity of the fetal lungs up to the time of ligation of the cord. Such terms as "suspended animation" and "apparent death," often proposed as substitutes for asphyxia neonatorum, appear to be even more objectionable than the latter, and, as a matter of fact, all the synonyms and substitutes thus far proposed appear to be applicable only to the terminal stage of subaeration of the blood.

Varieties.—The subject of asphyxia neonatorum consists of a number of different conditions which have a common tendency. Thus, when the child is *in utero* and labor is not impending various agencies may compress the cord and bring about the death of the fetus. Such a state of affairs might be termed "subaeration from cord compression ante partum" and might be fatal immediately, or if the constriction were not complete, a chronic condition would be set up, manifested by some form of arrested development. Under these circumstances the term "intrauterine asphyxia" would apply. If the child is alive and well up to the moment of the onset of labor, and during this act the cord is compressed, we should then have a condition of subaeration from cord compression intra partum. If the subaeration were complete, the child would be dead long before it could be extracted; but if only partial or temporary, it might be possible to reanimate the child after delivery. The cord being free from compression, the very act of labor itself in compressing the skull and thorax, and the added compression of the forceps when the latter is applied, will give rise to a condition which may be described as "subaeration from compression of the skull (intra partum)." What has been said of cord compression applies equally to disturbance of placental circulation *in situ*, and premature detachment of placenta. Some cases of this form are simple, others are complicated by intracranial hemorrhage; so that the children are born both asphyxiated and with paralyses of central origin. It is probable that most of the infants that are born in a state of subaeration from which they may be reanimated are examples of simple compression of the skull. If the child is born alive and does not begin to respire until the cord is cut, the condition has been termed physiological apnea. Many children utter no cry at birth and respiration is so shallow that it escapes observation. This is known as "false asphyxia." The child is doubtless in a condition of subaeration because the cord has been cut and the breathing is incomplete. From the fact that these children soon begin to breathe more naturally, the condition may be

regarded as physiological. This class of cases doubtless passes by imperceptible degrees into a more serious one, especially noted in congenitally feeble and premature children. Here the child attempts to breathe, but is unequal to the task of aerating its blood. It becomes cyanotic and succumbs at a variable period after birth. This might be termed "subaeration from prematurity or debility, post partum." When we consider that two or more of the preceding types of subaeration may coexist in the same child, the extreme complexity of the subject is apparent. The list might also be extended; thus, fetal subaeration is doubtless present in certain diseases of the mother, especially in convulsions, and in any maternal affection in which the blood is imperfectly aerated, particularly in cardiac and pulmonary diseases. Again, during labor chloroform narcosis may favor subaeration in the fetus.

FIG. 1008.—RESPIRATORY ORGANS AND HEART OF A FULL-TERM CHILD WHO DIED DURING LABOR OF INTRAUTERINE ASPHYXIA FROM PREMATURE RESPIRATION CAUSED BY PROBABLE COMPRESSION OF THE UMBILICAL CORD. 1, Aspired meconium in the respiratory passages; 2, numerous areas of ecchymoses of asphyxia in the heart and lungs.—(*Hofmann.*)

Pathology.— Pathological changes may be due to the asphyxia itself, in which case the blood is fluid, the right heart engorged, and the large thoracic vessels, sinuses of the dura, and hepatic vessels are in a state of distention. Extravasations often accompany the distention, especially in the viscera, and œdema has been noted in the pia, scrotum, and cord. Another set of pathological changes is found in the thoracic organs in cases in which premature respiration has occurred. In these cases the trachea and bronchi may be filled with mucus, amniotic fluid, meconium, etc. (Fig. 1008). Such substances constitute a demonstration of the fact that intrauterine respiration has occurred. These fluids may, however, be prevented from entering the trachea by the interposition of the membranes or the close contact of the maternal parts. The stomach may also contain meconium. Pulmonary ecchymoses are less frequent here than in post-natal asphyxia. In this form the evidences of premature respiration are absent. General atelectasis

will be found, even in children who have been reanimated. The pathological changes in the intrauterine form are analogous to those of ordinary suffocation. The blood, which is thin, fills the cerebral sinuses. The membranes are œdematous. The lungs have a dark hue and the respiratory passages are filled with liquor amnii and debris. Occasionally air is found in the lungs. Extravasations and ecchymoses are found in the various organs, which are congested (Fig. 1008). Soft, dark clots distend the right heart. In the extrauterine form we often find large areas of atelectasis in the lungs. There will be visible the external signs of the forces that have produced the condition. The organs exhibit structural changes. The lungs and heart as well as the diaphragm and brain are often imperfectly formed. Intrauterine pneumonia or pleurisy may be present. When ineffectual respiratory efforts have occurred, the lungs are more markedly congested and numerous hemorrhages are scattered over the visceral pleura. The lungs are engorged to such an extent that they are heavier than water; when immersed they sink at once. One proof of premature respiratory efforts is the presence of a greenish fluid which may be pressed from the cut surface of the lungs and which may be found in the trachea.

FIG. 1009.—FACE OF A NEWLY BORN CHILD COVERED BY A PORTION OF THE MEMBRANES. A possible cause of asphyxia in the newly born.

Etiology.— Anything which tends to interrupt the flow of blood toward the fetus through the placenta and cord will shut off its oxygen. Hence, either compression of the cord or premature separation of the placenta is the most natural cause of asphyxia. Tetanoid contractions of the uterus in which the muscular action is continuous will also arrest the placental circulation. Another condition under which asphyxia may develop is the so-called "vaginal birth" which occurs at times in breech presentations. Here the placental circulation is interrupted while the head is still in the vagina and remote from atmospheric air. There are a number of conditions which favor the development of asphyxia and which are divisible into *maternal* and *fetal*. Such conditions do not produce a forcible shutting-off of the oxygen supply, and the mechanism by which asphyxia develops in these cases is by no means clear. There occurs a suppression in the amount of oxygen which reaches the fetus, either because of scarcity of that substance in the maternal blood, or of some anomaly of the fetal organs which interferes with the oxygenation of the blood. Hemorrhage in the mother, by greatly reducing the number of red corpuscles, and thereby interfering with the oxygen supply, becomes a cause of asphyxia. In fetal asphyxia from eclampsia the shutting-off of the oxygen supply might be due to interference with maternal respiration or to a tetanic condition of the uterus. Only after the fetus is born can the various conditions, such as persistence

of the foramen ovale, atresia of the pulmonary artery, etc., come into play. Causes from interference with pulmonary respiration begin to be operative before delivery to the extent that the entrance of maternal secretions, meconium, etc., into the breathing passages may obstruct the first efforts at respiration. Persistence of the membranes unruptured will have the same effect; likewise the fact of so-called vaginal birth (Fig. 1009). Again, when the child first attempts to breathe by the lungs the presence of a disease or malformation may be evident for the first time; *e. g.*, atresia of the pulmonary artery, persistence of the foramen ovale, congenital atelectasis. An entirely different mechanism obtains in asphyxia from brain compression. When there are no evidences of interference with placental circulation through the agencies already described, we are forced to explain asphyxia due to brain compression by the profound slowing of the fetal heart which diminishes the oxygen received to such an extent as to cause death. It is claimed that compression of the skull paralyzes the respiratory center.

Symptoms.—The phenomena known collectively as asphyxia, subaeration, oxygen-hunger, etc., however produced, are essentially the same in nature, presenting every degree of intensity from mere irregularity and superficiality of breathing to a condition of apparent death. Despite this gradation in intensity of manifestation, the great majority of authors still cling to the old fundamental subdivision of *blue* and *white asphyxia*. The former term indicates a condition of cyanosis, but differs from the white or anemic variety not so much in color as in the behavior of the muscular system, the latter preserving its tonus in the blue type, while in the white asphyxia a state of complete muscular relaxation exists. Blue asphyxia or cyanosis due to a sudden accumulation of carbonic acid in the blood is believed to pass naturally into the anemic or white stage, which is therefore held to be the terminal manifestation; yet this distinction is of little value in practice because in the white variety it is not only often possible to resuscitate children thus born, but spontaneous recovery under these circumstances is far from exceptional. I am in favor of doing away with the color test or blood test, and of placing the chief reliance upon the state of the muscles in determining the degree of subaeration. In mild or medium degrees of the latter the pharyngeal reflex is preserved, while in the highest degrees it is absent. Whether or not there is complete concordance between the state of the blood and the condition of the musculature does not appear to have been determined. When the pharyngeal reflex is absent, the lower jaw hangs loose. Another test of extreme asphyxia is found in the failure of the heart to respond to the various forms of cutaneous stimulation. The *blue asphyxia* is characterized clinically by a livid redness or blueness of the face and upper parts of the body. The face is turgescent and the eyeballs are prominent and injected. The muscles of the extremities, neck, and jaws are rigid, and the heart action is strong. In children thus born the cord is found to pulsate strongly. The reflexes and sphincters behave in a normal manner. Children born with blue asphyxia may recover promptly or only after a considerable interval; or the condition may pass into the *white* or *anemic form*. Here the condition superficially present in blue asphyxia appears to be inverted. The surface is pale instead of livid. The face is pinched, the muscles, including the sphincters, are all relaxed. Circulation is at a standstill, and not only is the heart-beat difficult to recognize, but there is no escape of blood when the surface is incised. Children born with white asphyxia have a small, almost pulseless cord. All in all, the subject of the symptomatology of asphyxia neonatorum is in a most unsatisfactory state.

Diagnosis.—Diagnosis before delivery is made (1) by the aid of information

afforded by the fetal heart-sounds, which undergo alterations in quality and frequency; (2) by the presence of meconium in the discharges (except in breech presentations), and occasionally (3) by the intrauterine cry heard in the lower part of the canal or the evidence of respiration in the same locality. Diagnosis after delivery is made by recognition of the clinical picture of diminution or absence of circulatory and respiratory phenomena. In regard to vaginal birth, inspiratory efforts of the fetus while the head is in the vagina are betrayed by a peculiar quivering of the skull (in head presentations). In this connection it should be stated that this phenomenon is equivalent to an indication to terminate labor immediately.

Prognosis.—As long as there is cardiac action there is hope of resuscitation. Generally speaking, the prognosis is always grave, varying with the degree of asphyxia. Spontaneous efforts at respiration constitute a favorable sign. It must be remembered that the failure of respiration may be owing not to ordinary asphyxia, but to another affection, such as a trauma affecting the respiratory center, atelectasis, intracranial hemorrhage, etc. If efforts at reanimation are successful, the prognosis is still far from favorable, as death frequently occurs from atelectasis, paralysis, convulsions, pneumonia, etc. Regarding the prognosis *in utero*, we should not forget that the interruption of the placental circulation may be only temporary. The tendency of the child to make inspiratory efforts whenever the placental circulation is interfered with is not one of self-preservation, for the asphyxia is thereby rendered worse, since the blood is forced from the right heart into the lungs. On the other hand, the aspiration of amniotic fluid, etc., does no harm, but tends to inhibit the respiratory movements.

TREATMENT.

Prophylaxis.—This includes everything which tends to promote eutocia, such as correction of malposition before labor is under way; acceleration of delivery by manual compression; correction of positions which threaten impaction; speedy relief of spastic rigidity of the cervix; preservation of the bag of waters; avoidance of abuse of chloroform. Here also belongs the proper management of the child after birth. Extreme measures have sometimes been recommended or practised for the prevention of asphyxia. Thus, Rapin performed insufflation of the amniotic sac on a number of occasions. He introduced the air by means of a catheter and syringe, 500 to 600 c.c. at a time. It is self-evident that the air could not enter the uterine sinuses, protected as they were by the amnion. Rapin claims good results.* A still more radical procedure is the performance of tracheotomy when during a breech delivery the head is arrested at the brim. By means of a tracheal tube the lungs may be inflated and respiration begin in this locality.

Curative Treatment.—Here we have four well-defined indications—namely: (1) immediate delivery, the diagnosis of intra-partum asphyxia having been made (page 816); (2) removal of foreign substances from the respiratory passages immediately upon the birth of the child; (3) the restoration of respiration by reflex stimuli, artificial respiration, or insufflation of the lung; (4) treatment of shock.

1. Immediate Delivery.—The choice of means will in most cases be in favor of the forceps. Often a preliminary bimanual completion of cervical dilatation will be demanded. After the expulsion of the child, if cyanosis is evident, the cord should be divided at once and allowed to bleed about an

* "Ann. de gyn. et d'obstét.," Sept., 1899.

ounce. It should be remembered, however, that immediate ligation of the cord is in itself equivalent to depriving the child of an ounce of blood. In the anemic form of asphyxia we should cover the child with hot flannels and wait for the pulsations of the cord to cease.

2. Removal of Foreign Substances from the Air-passages.—The second indication is to cleanse the respiratory passages of fluids aspirated during labor. This can be accomplished in part by inverting the child and swabbing out its mouth with the little finger wrapped in gauze (Figs. 1010, 1011). The contents of the nose should be squeezed out. This cleansing of the mouth and nasal passages should be begun as soon as the head is born. Some obstetricians claim that respiration is the best and most rational means for cleansing the lower air-passages. Hence after the preliminaries just described they either attempt to excite natural respiration by reflex stimuli, or in more serious cases proceed at once to arti-

Fig. 1010.—Suspension of the Asphyxiated Newly Born Child by the Feet to Assist Gravity in Freeing the Air-passages of Foreign Matter.

Fig. 1011.—Suspension of the Asphyxiated Newly Born Child by the Feet, and Clearing the Posterior Pharynx of Foreign Matter with the Little Finger Wrapped with Gauze.

ficial respiration. Other authorities believe in the advisability of direct aspiration of the secretions by special devices or by an ordinary catheter. This last practice I am accustomed to follow. The same apparatus may be used to aspirate the larynx and perform insufflation. All attempts, however, to enter the larynx should be frowned upon. Practice upon the cadaver will readily impress one with the barbarousness of such an attempt upon the newly born child. The most that can be accomplished by aspiration is the removal of mucus from the lower part of the pharynx. A No. 6 catheter may be made to answer, into the middle of which I insert a pipette, so that its bulbous expansion catches the

aspirated fluids which might otherwise enter the operator's mouth (Fig. 1012). If a catheter is used, it should be open at the end.

3. Restoration of Respiration.—(1) *Reflex Stimuli.*—The third indication in the treatment of asphyxia is to excite the respirations. There are two methods of doing this: viz., reflex stimulation and artificial respiration. The former may suffice in mild cases. The usual forms of stimuli applied include blowing in the face, slapping the buttocks, sprinkling or immersing, hot and cold water being used alternately. The child being nearly immersed in warm water, cold water, alcohol, or ether may be dropped from a height on the exposed chest. Laborde's method of tongue traction is really a reflex stimulus, although usually classified under artificial respiration. Cooke's method of dilating the anus with the finger also belongs here.

(2) *Artificial Respiration.*—The various methods now in vogue are as follows:

(*a*) *Byrd's Method.*—Dr. Byrd * described a method of artificial respiration as follows: "Bring the ulnar sides of the hands together with the palmar surfaces looking vertically; then prop them beneath the back of the infant so that the extended thumbs may aid as far as possible in sustaining the vertex and inferior extremities. Then, keeping the ulnar borders of the hands in contact so as to form a fulcrum, the radial borders or sides are simultaneously depressed to as great an extent as practicable, say 45 degrees, below the horizontal line, and then gradually elevated or pronated as many degrees above that line, thus facilitating

Fig. 1012.—Aspirator for Removing Foreign Matter, as Blood, Mucus, and Meconium, from the Posterior Pharynx by Suction.

the escape of air drawn into the lungs during the downward movement of the head and chest. These movements performed in a regular and gentle manner and repeated at proper intervals seldom fail in the establishment of respiration where it is possible of accomplishment." Dr. Byrd gives three illustrations of this method. Byrd's method has been somewhat modified in the past thirty years, principally by Dr. Dew, of New York, so that to-day it is often performed as follows: It should be remembered that Byrd's method can be carried out with the child in a warm bath. The infant is grasped with the right hand, the neck supported between the thumb and the index-finger (Fig. 1013). The head is allowed to fall backward unrestrained. The palm supports the shoulders while the three last fingers in the axilla lift the arm upward and outward. The left palm is placed beneath the thighs with the fingers grasping the knees (Fig. 1014). Inspiration is induced by arching the body of the child. The depression of the pelvis and lower limbs causes descent of the diaphragm through the traction upon the abdominal viscera, while flexion at the upper portion of the vertebral column elevates the ribs and separates them. Expiration is induced by reversing the movements. The hyperextension of the spine is changed to extreme flexion (Fig. 1015). The elevation of the head and shoulders tends to approximate the ribs, while extreme flexion of the thighs crowds the diaphragm upward through the pressure of the abdominal viscera. At the completion of expiration the child should be inverted, head downward, while an assistant clears the mouth and nose

* "Baltimore Med. Jour.," 1870, I, 646.

of any accumulated mucus with a gauze-wrapped finger (Fig. 1015). Byrd's movements should be repeated six or eight times a minute. If properly performed, the air can be heard entering the glottis during artificial inspiration, while expiration often results in the expulsion of aspirated amniotic fluid and mucus.

FIG. 1013.—BYRD'S METHOD OF ARTIFICIAL RESPIRATION. POSITION FOR INSPIRATION.

FIG. 1014.—BYRD'S METHOD OF ARTIFICIAL RESPIRATION. POSITION BETWEEN INSPIRATION AND EXPIRATION.

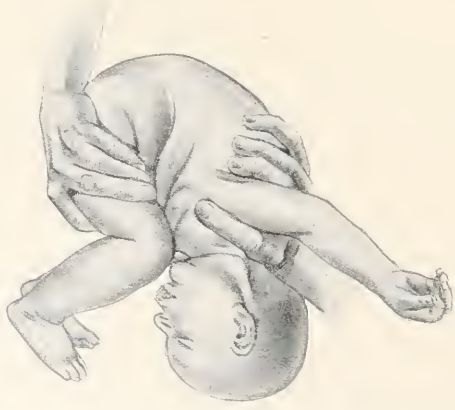


FIG. 1015.—BYRD'S METHOD OF ARTIFICIAL RESPIRATION. POSITION FOR EXPIRATION. Note the inversion of the child to assist in freeing the air-passages.

(*b*) *Schultze's Method.*—This has been recently (1901) described by Schultze himself as follows: The child lying upon its back is grasped by the shoulders, the open hands having been slipped beneath the head. The last three fingers remain extended in contact with the back while each index is inserted into an axilla, the thumbs lying upon and in front of the shoulders (Fig. 1016). When the child thus held is allowed to hang suspended, its entire weight rests upon the two fingers in the arm-pits. It is now swung forward and upward, the operator's hands going to the height of his own head, the pelvic end of the child rises above its head and falls slowly toward the operator by its own weight, flexion occurring in the lumbar region (Fig. 1016). The thumbs in front of the shoulders compress the chest while the hyperflexed lumbar vertebræ and pelvis compress the abdomen, and through it the thorax; finally, the last three fingers on each side compress the thorax laterally. As a result of this manœuver when properly done, aspirated secretions flow abundantly from the mouth. The distended heart also feels the compression, which forces the blood into the arteries. The child is now swung back into its original position and supported

entirely by the fingers in the axilla (Fig. 1016). The compression of the thumbs and last three fingers is removed. The downward swing elevates the sternum and ribs while gravitation and the traction of the intestines depress the diaphragm. It is often possible to hear the air rush into the infant's glottis as it reaches the original position, although this can occur in a cadaver. The amplification of the thorax lowers the intracardiac pressure. The child should be swung up and down ten times for the space of a minute. The effects of the manœuver should be as follows: The heart-beat increases in frequency, the cadaveric pallor of the skin becomes replaced by a rosy hue, and the muscular tonus appears. The child is then placed in a warm bath and watched. If the inspirations are superficial, a momentary dip in cold water is indicated. If the heart action becomes poor, the child should be swung again. If prolonged swinging becomes necessary, the root of the tongue should be compressed forward in order to raise the epiglottis and permit the removal of secretions with the fingers. In premature children the thoracic walls are often too soft to benefit by the compression of the fingers. In these cases insufflation of air should be practised.

Fig. 1016.—Schultze's Swinging Method of Artificial Respiration. The upper figure is the position of expiration and the lower that of inspiration.

(*c*) *Sylvester's Method* (*Modified*).—This method of artificial respiration requires an assistant. The child is placed on its back with the head supported (not to such an extent that the chin compresses the sternum). The thorax is slightly elevated by a towel placed beneath it. The feet are firmly held by an assistant with a towel. The physician stands behind the child's head. To imitate inspiration the arms are grasped near the elbows and brought close together above the head, while at the same time gentle upward traction is made. The assistant makes counter-traction upon the feet. The movements expand the ribs, although the change in the intrathoracic pressure may be manifest at first only by retraction of the abdomen. If the movements are continued with the arms somewhat everted to put the pectoralis major upon the stretch, the air gradually begins to enter the chest. Expiration is imitated by bringing the elbows down and against the sides. The arms are somewhat inverted, which brings the forearms across the chest. The operator's hands also make compression upon the thorax, so that air is forced from the latter, carrying perhaps some secretion with it. The movements are made at the rate of twenty a minute. The mouth should be wiped out from time to time, and if the passages are still clogged the child should be inverted and the chest compressed. If spontaneous respiration begins, the movements must be timed in harmony with it; this is of vital importance. When natural respiration is able to replace artificial measures, it should be assisted by ordinary

reflex stimulation. The efficacy of this method is shown by the fact that it can maintain the circulation in cases in which the respiratory paralysis is complete.

(*d*) *Prochownik's Method.*—The child is held inverted by the legs, the operator's right hand grasping the ankles with the index finger between (Fig. 1027). The head is supported below to an extent sufficient to produce full extension. Both hands of an assistant compress the thorax until all secretions come away. When the hold on the thorax is released, inspiration takes place. After repeating the movements six or eight times the child is placed in a hot bath. An advantage of Prochownik's method is that it antagonizes the development of aspiration-pneumonia.*

(*e*) *Laborde's Method.*—This consists in exciting the respiratory center by rhythmic tractions upon the tongue. The latter is drawn out with the fingers

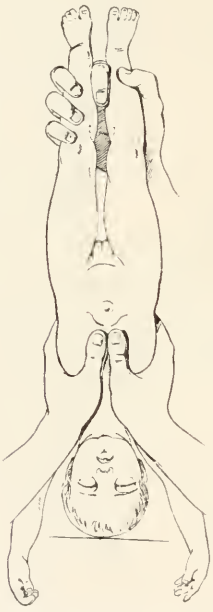


Fig. 1017.—Prochownik's Method of Artificial Respiration.

Fig. 1018.—Method of Infusing Saline Solution into the Umbilical Vein of the Newly Born for Some Varieties of Asphyxia.

(enveloped in a piece of gauze) some fifteen to thirty times a minute. After each act of traction it is allowed to fall back into its customary position. It appears to stimulate the respiratory center through the proximity of the latter to some of the other medullary centers which are acted upon by the tractions.

(3) Insufflation.—Opinions as to the utility of this resource are of great variance. Some mention it as the first, others as the last resort. It may be practised with or without instruments. The former comprise special tracheal tubes which are difficult of introduction, and apparatus designed to cover the nose and mouth of the child. An ordinary stethoscope will answer the latter purpose. If a tube is used, it should be introduced by the aid of a finger

* This author's original paper may be consulted in the "Ctbl. f. Gynäkol.," 1894, p. 226.

which has previously located the arytenoid cartilages. If the tube enters the esophagus, insufflation will inflate the belly. In insufflation without instruments—the mouth-to-mouth method—the child lies supine with chest elevated, as in Sylvester's method of artificial respiration. The operator breathes into the mouth through gauze; the thorax should be compressed gently after each insufflation.

(4) Shock Treatment.—The fact that measures that belong under this head are of such value in asphyxia apparently justifies the theory that the condition itself possesses a considerable element of shock. These measures comprise the application of heat, either dry or moist, the child being wrapped in hot flannels or immersed in hot water; hot saline infusion into the rectum; hypodermics of brandy (five or six drops) or of strychnin ($\frac{1}{200}$ grain).

(5) Umbilical Infusion.—Success has attended infusion through the umbilical vein after all the customary resources have proved inefficient.* The infusion is something more than an ordinary saline solution, for Schücking added fructosate of soda, a substance which is believed to take up the excess of carbonic acid in the blood with the formation of sodium carbonate and sugar. The formula used is as follows: Fructosate of soda, 0.5; sodium chloride, 0.7; boiled water, 50 c.c. The apparatus employed is a graduated bottle, a tube, and a cannula (Fig. 1018). The umbilical vein is cut across and the cannula inserted. Thirty cubic centimeters are thrown in at first, followed by a second infusion of 20 c.c. As soon as the heart and respiration start up, ordinary measures are resumed.

Résumé.—(1) In premature and feeble children Byrd's method of artificial respiration should be practised, with the child immersed in hot water or between hot flannels. Insufflation should be practised by the mouth-to-mouth method or by catheter. (2) In the apoplectic or livid form Byrd's method should be used, varied with a few swings à la Schultze. Lest the surface become chilled from exposure, the child should then be placed immediately in hot water. (3) In the anemic or pallid form Sylvester's or Byrd's method should be used, with the child between hot flannels.

2. FETAL TRAUMATISMS OF BIRTH.

1. Traumatisms of the Brain and Cord.—Injuries to the skull and brain are due to obstructed labor, to the faulty application of the forceps, or to faulty extraction of the after-coming head. The lesions which are thus brought about comprise simple compression of the brain without hemorrhage (one of the chief factors in the production of intra-partum asphyxia) and intracranial hemorrhage, which is nearly always meningeal. Naturally the results of compression often coincide with hemorrhage, so that to asphyxia are conjoined the consequences of effusion of blood within the cranium.

Cerebral Apoplexy.—When the blood is extravasated upon the surface of the brain or between the meninges, the term meningeal apoplexy is used; if in the substance of the brain, cerebral apoplexy. No small number of infant deaths either during or closely following the act of parturition are referred to intracranial hemorrhage. *Etiology:* Some few cases are due to syphilis, and in early hemorrhages the exact nature of which has not been definitely determined direct injury, a blow or a fall in the later months of pregnancy, and the accidents of precipitate labor have been responsible for others; but the great majority are in some manner connected with tedious labor, whether as a result of breech,

* Schücking: "Ctbl. f. Gynäkol.," June 7, 1902.

transverse, or brow presentation, contracted pelvis, insufficient uterine power, version, the too early rupture of the membranes, or fetal abnormalities. The injudicious and indiscriminate use of the forceps is a potent factor. *Pathology:* Within the skull there is no zone of freedom from hemorrhage; it may be epidural or subdural, within the meninges or in the brain substance itself. It occurs at the vertex or base, and varies in amount from very small extravasations to those which cover the entire brain substance. In early life meningeal hemorrhage is much more common than the cerebral variety and basal hemorrhages greatly outnumber those of the convexity. The most common seat is beneath the pia mater, less frequently into the cavity of the arachnoid, the blood escaping in these situations and spreading uniformly in all directions. *Symptoms:* The symptoms agree quite closely with the pathological conditions just described. They are more uniform, but vary according to the seat as well as the quantity of the effused blood. When due to the ordinary causes of protracted labor, the infant is born apparently dead, resuscitation is gradual and difficult, the cry is feeble, the eyes are motionless, and the extremities are limp and flaccid. The face is livid or pallid and the respirations are gasping. By means of hot and cold baths, artificial respiration, friction, the general condition of the infants may show slight improvement, but ordinarily they succumb after living a few hours or a few days. Depending upon the distribution of the blood-clots and the amount of intracranial pressure, various degrees of paralyses of the face, arms, and legs may occur, and convulsions and rigidity of the entire body are often present. In the cases which survive the early days of life the rigidity of the trunk and extremities may persist and the degrees of paralysis may be definitely determined. In favorable cases the improvement goes on more or less slowly and scarcely ever becomes more than partial. Contractures and other deformities from the permanently paralyzed muscles are sequelæ of frequent occurrence. *Prognosis:* If the infant survives, the smaller extravasations are gradually absorbed and the surrounding parts tend to assume their normal functions. Extensive hemorrhage is usually fatal. As a rule, the prognosis depends on the severity of the early symptoms; the deeper the unconsciousness and the more deficient the respirations and pulse, the less the prospect of recovery. Many cases of epilepsy and idiocy can be traced to a probable hemorrhage in the brain occurring during or after a prolonged or an instrumental labor. In other and rare cases recovery is to all appearances complete. *Treatment:* In view of the fact that prolonged labor is responsible for the majority of cases, the indications for treatment are almost wholly preventive. Impacted infants should be delivered with all possible despatch. Forceps and other operative measures must be employed with judgment, brain pressure being avoided as much as possible, remembering that during the progress of labor a child about to be born is made up of a mass of delicate organs and tissues incapable of resisting unnecessary force. Asphyxia demands immediate and persistent efforts to inflate the lungs fully.

2. Injuries to Nerve-trunks.—(*a*) Facial Paralysis.—*Traumatic facial paralysis* is usually due to compression of the nerve by the forceps at or near the stylomastoid foramen, but may sometimes occur in spontaneous delivery (Fig. 1019). In forceps accidents only one or more of the branches of the nerve may be injured, so that only a portion of the distribution of the nerve may be paralyzed (most frequently the temporofacial branch). Forceps paralysis is chiefly unilateral, because only one side of the face is exposed to the instrument. *Spontaneous facial paralysis:* The subject of forceps paralysis is a relatively simple one, but it is otherwise with the facial paralysis of spontaneous delivery. This acci-

dent is of rare occurrence, and not more than a dozen cases were upon record up to the year 1900. These cases have been collected and analyzed by Vogel.*

Etiology.—This is either *traumatic* or *spontaneous* in origin. The former is due to compression with forceps and is usually unilateral, and limited to certain portions of the nerve-distribution, most frequently the temporo-facial branch. The spontaneous type is much more complex. Recorded cases are few in number, and the mechanism appears to vary greatly. In the absence of any definite type every case has an atypical character.

FIG. 1019.—FACIAL PARALYSIS OF THE NEWLY BORN.

FIG. 1020.—FACIAL PARALYSIS DUE TO PRESSURE OF A FORCEPS BLADE.—(*Ahlfeld.*)

FIG. 1021.—DEPRESSION IN LEFT PARIETAL BONE.

FIG. 1022.—TRAUMATIC DEPRESSION OF THE RIGHT PARIETAL BONE.—(*Ahlfeld.*)

* "Monatschrift f. Geburtshülfe und Gynäkologie," vol. XII.

Contracted pelvis seems to be a factor of importance. Any clear evidences of compression or stretching seem to be wanting.

Symptoms.—Facial paralysis may be apparent at birth or within the few days following. It has no tendency to become worse. During repose the only symptom in evidence may be the open eye of the affected side,—due to paralysis of the orbicularis. When the child cries, the mouth is drawn to the affected side.

Diagnosis.—This is self-evident, save that a similar monoplegia might possibly be due to an intracranial lesion.

Prognosis.—This is essentially benign; only in a few known cases has the injury been so severe that recovery was impossible.

Treatment.—The eyeball, if exposed, must be protected. If spontaneous improvement is in evidence after the tenth day, the case may be left to itself. If no improvement sets in, or if progress is stationary, faradism should be employed, followed, if necessary, by galvanism. This latter may be continued for months if the reaction of degeneration does not appear.

(*b*) Brachial Birth Palsy.—This subject belongs principally to neurology and orthopedics, because the nature and extent of the pathological state are seldom in evidence during the lying-in period. In recent years the condition has assumed considerable importance, and the older views are undergoing marked changes. To those interested in the details, I recommend especially the monographic study of Clark, Taylor and Prout,* and an article by J. J. Thomas.† In the present connection I shall consider the subject only as it concerns the obstetrician.

Definition.—Paralysis involving the muscles of the upper extremity depending upon injury to the brachial plexus during delivery.

Frequency.—This cannot be determined, because of our ignorance of the state of the brachial plexus in the still-born and in infants who succumb soon after delivery. Further, very mild and transitory cases in survivors may pass unnoticed. The absolute frequency in surviving infants has been computed at 1 : 2000.

Varieties.—The numerous varieties of palsy described by neurologists are naturally not much in evidence during the lying-in period. It is enough to state that while usually unilateral, both sides may be involved. A small proportion of cases are mild and self-limited. Very exceptionally cord lesions may coexist, with paralysis of the lower extremities. If the first dorsal nerve is involved, we may see pupillary phenomena.

Etiology and Mechanism.—The injury to the plexus which causes the paralysis may come about in various ways. We have to consider in this connection, not only the character of the lesion, but the type of delivery through which the latter is caused. While a certain number of cases may be due to mere compression, such as may arise in connection with simple disproportion, the hooked finger in the axilla, forceps-pressure and fracture, dislocation and diastasis of bony structures, the great majority must be due to a stretching or tearing of the roots of the brachial plexus, the latter mechanism (laceration) being responsible for most of the graver cases. Conditions favoring laceration are encountered in head presentations with rotation or traction by forceps, and in attempts to extract the shoulders; also—in about equal proportion—in extraction of breech-cases under all conditions. A small proportion of cases occur in spontaneous head delivery. Experiments on the cadaver show that the fifth cervical root is the first to give way in stretching, and it is probable that when this root is alone

* "Am. Jour. Med. Sci.," Oct., 1905. † "Boston Med. and Surg. Jour.," Oct. 19, 1905.

involved, the case is a relatively mild one. With progressive increase in traction the sixth, seventh, and eighth roots become involved.

Pathology.—Actual lesions are in plain evidence only when a nerve-root is lacerated, either completely or in part. The neurilemma is the first structure to yield and doubtless the sole one in some cases. A hemorrhage is bound to follow, so that in any actual lesion a hematoma must result, although in mild cases it may be slight and quickly absorbed. As a rule, the cicatrix left by organization of the clot is able to compress the nerve-trunk and prevent regeneration in nerves torn through, as well as cause traumatic neuritis in trunks not actually severed.

Symptoms and Diagnosis.—These vary greatly with the degree of injury and are characteristic only for high degrees. In typical cases, these being of upper arm type, the attitude is characteristic. There is palsy of the deltoid and supraspinatus, so that the arm hangs powerless by the side; the forearm is in extension (paralysis of flexors) and the hand in extreme pronation (paralysis of supinator brevis and biceps), and the whole arm so rotated inward that the palm looks backward and outward (paralysis of the supraspinatus, infraspinatus, and teres minor). Aside from the clinical picture, there often develop later evidences of traumatic neuritis due to compression of the organizing blood-clot. The limb is tender and irritable on handling, and the child peevish and fretful. As these evidences of neuritis are certain to be followed by more or less secondary palsy, absence of them is a favorable sign. In the more severe cases some of the antagonist muscles undergo more or less contracture, increasing the deformity due to atrophy of the disused paralyzed muscles.

Prognosis.—If the condition is due exceptionally to compression or very mild laceration, spontaneous recovery may ensue in from three to nine months, although the limb may never attain its natural development and usefulness. In higher degress of laceration, the prognosis depends on the size of the clot and its influence upon the continuity of the nerve. The limits vary between relative recovery and total paralysis. If well-defined traumatic neuritis of the nerve-roots develops, the prognosis is much worse, and the same is true if the deep cervical fascia is injured and must undergo repair.

In general, considering all cases, the prognosis is unfavorable—about one recovery in four cases.

Treatment.—Palliative treatment should always be undertaken on account of the uncertainty of the outcome, for delayed spontaneous recovery is not out of the question. Here massage, hot and cold douches, passive motion, and electricity come into play, as well as orthopedic devices, for all these measures tend to overcome contractures and the like. But if there be marked evidence of traumatic neuritis, complete immobilization is indicated until all evidences of inflammation have subsided. The extremity should be immobilized in the natural position, which overcomes the tendency to contracture of the great pectoral. After subsidence of the neuritis, active measures may be employed. Electricity not only maintains muscular tonus, but is said by Bethe to promote nerve regeneration.

Radical treatment may be undertaken whenever palliative measures seem to have accomplished their limit of good. This period varies from three months to a year. Apparently nothing is lost by waiting for the latter period, although good results may be obtained at a much earlier date. A compromise may be obtained in cases which show no improvement under medical measures by the fourth to sixth month.

Whenever it appears that the obstacle to recovery is a cicatrix involving nerve-

continuity, an operation is indicated. In certain cases simple neurolysis should suffice; but as a matter of fact there is generally a separation of the nerve-segments which requires suture of the divided ends. This treatment will at least prevent many of the sequelæ of neglected cases of paralysis, even if it does not conduce to restoration of function.

3. Injuries to the Cranial Bones.—These comprise (*a*) depressions, (*b*) fractures.

(*a*) Depressions or Indentations.—The occurrence of depressions or indentations in the fetal cranial bones does not imply the existence of a depressed fracture, although the latter might also be present. These lesions are very infrequent occurrences—according to Ahlfeld, not over once in three hundred living births. *Etiology:* They are due to some disproportion between the fetal cranium and the maternal pelvis when the latter is contracted, the impression being made by the sacral promontory, for example; or to the forceps, or even to the finger of the accoucheur. These impressions have usually the dimensions of the imprint of a man's thumb in wax (Fig. 1023). They are chiefly encountered in children born alive and the latter generally survive. *Prognosis:* The lesion is quite likely to rectify itself spontaneously, either wholly or in part, but in case it persists through life it has seldom been known to give rise to any intracranial mischief. *Treatment:* It has been proposed to trephine in cases in which paralysis appears to be due to this injury. I have seen good results in one case. With this possible exception, there is hardly any treatment for impressions of the skull. It is claimed that the application of dry cups is sufficient to correct the deformity, which, however, had better be left to itself.

Fig. 1023.—Depression in the Right Parietal Bone Caused by the Faulty Application of the Forceps.—(*Author's collection of fetal skulls.*)

Fig. 1024.—Contusion and Sloughing of the Scalp Caused by a Contracted Pelvis.—(*Ahlfeld.*)

(*b*) Fractures.—These have also been noted after both spontaneous and artificially aided delivery under the same circumstances which give rise to indentations, although cases have been placed on record in which both the pelvis and the fetus were quite normal, and the only possible source of violence was the uterine contraction, possibly excited by the use of ergot. The parietal is said to be the bone most frequently fractured, but this was not the

case in the statistics collected by Lomer. Any one of the cranial bones may be involved. Rupture of the sutures and detachment of some one of the bones may take place under the same circumstances. If fracture of a bone or rupture of a suture should be complicated by the laceration of a sinus or large blood-vessel, fatal hemorrhage will result. Minor degrees of hemorrhage from rupture of small vessels or some lesion of the substance of the brain may also complicate these fractures. As in the case of trauma of the bones of the adult skull, we must bear in mind the possibility of remote consequences.

Facial Bones.—Fracture of the bones which make up the orbit is of occasional occurrence, as are likewise fractures of the lower jaw and diastasis of its symphysis. Fracture into the orbit—usually through the frontal bone—is followed by exophthalmus, yet this latter phenomenon has also been noted after simple application of the forceps over the temporal region without the production of trauma. Rupture of the bulbus oculi and other intraorbital lesions may complicate fracture into the orbit. While the latter form of injury is ascribed chiefly to the use of forceps, all the phenomena thus produced, including rupture of the globe, have been noted in spontaneous delivery; while, on the other hand, experimental fracture on the cadaver into the orbital cavity by means of the application of forceps I have found to be an impossibility. It is therefore evident that the

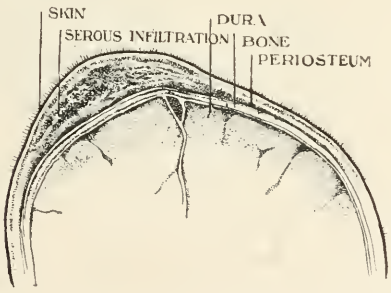


FIG. 1025.—CAPUT SUCCEDANEUM.

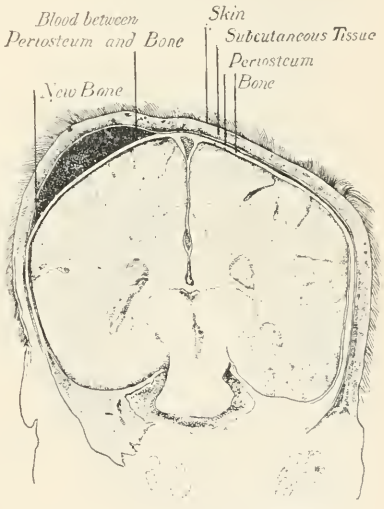


FIG. 1026.—CEPHALHEMATOMA.

rationale of these orbital injuries is not wholly clear. Fractures of the lower jaw occur, as a rule, from traction on the after-coming head in breech presentations.

4. Fractures of the Long Bones.—As a rule, the violence exerted in connection with dystocia and its management tends to produce diastasis rather than fracture, provided that the long bones of the fetus are healthy. When for any reason (fetal rickets) these structures are brittle, very slight manipulation may produce a fracture. But Ballantyne records the case of a fracture of the shaft of the thigh in a healthy child during normal delivery. There were no evidences of fetal rickets or prematurity. Apparently spontaneous fractures, whether in the healthy or otherwise, cannot justly be put down as examples of birth-trauma. If recognized, fractures and diastases may readily be healed.

Dislocations.—The luxations which are occasionally present at birth are believed to be due in most instances to malformations of the joints. (See Congenital Dislocation of the Hip.) The possibility of arrested development of the joint in these cases tends to invalidate the notion that luxation occurs as a pure birth traumatism, despite its general plausibility.

5. Injuries to the Scalp.—Among those I include (1) the caput succedaneum and (2) cephalhematoma.

(1) CAPUT SUCCEDANEUM.—The caput succedaneum, otherwise known as "false cephalhematoma," occurs with such frequency as to be almost physiological, the location varying with the position of the child's head during delivery. This condition is a phenomenon of labor itself as well as an affection of the newly born child, and is a subcutaneous, serous infiltration of that portion of the presenting part corresponding to the center of the birth canal (Fig. 1025). As the presenting part is forced through the os uteri or the vulva, it escapes the compression to which the surrounding tissues are being subjected, with the result that in this free area a sero-sanguineous effusion occurs, since the constriction about the presenting part interferes with the circulation. As a rule, this swelling does not form until after the membranes have been ruptured and frequently it may not form at all, as in cases in which delivery occurs very rapidly, or if the maternal parts are disproportionately large. While a certain amount of blood is present in the effused liquid, actual hemorrhage is rare. The caput succedaneum varies considerably in size and shape. It may be rounded, oval, or elongated, and varies in its long diameter from less than one inch (2.54 cm.) up to three inches (7.62 cm.). The skin over the caput is congested, and if the labor has been unusually long, it may present a purplish hue. As the presenting part must traverse several obstacles to its egress, the caput succedaneum may be formed within the uterus, within the pelvic canal, or at the vulval orifice, and it is not uncommon for a primary swelling to develop when the head passes the os and a secondary caput to form concentrically at a point farther down, especially at the vulval orifice. If there is narrowing within the resisting bony canal of the pelvis, the caput may be of extreme dimensions and may be born before the head has traversed the superior strait. (Compare Vertex, Part IV, and Face, Breech, and Shoulder Presentations, Part V.)

FIG. 1027.—CAPUT SUCCEDANEUM OF LEFT PARIETAL BONE SEEN FROM BEHIND. Note also the lateral flexion of the fetal body. Compare Fig. 573.—(*From Dr. W. E. Studdiford's frozen section at the Emergency Hospital.*)

(2) CEPHALHEMATOMA.—In this affection the escape of blood is between the periosteum and bone, while in caput succedaneum the site of the effusion is subcutaneous. The extravasated liquid consists wholly of blood (Fig. 1026). *Site:* The swelling is usually over a parietal bone and limited by some of the sutures. Occasionally it transgresses the sagittal suture and lies over both parietals. The right side of the head is the more commonly affected. Location of the tumor over the other cranial bones occurs infrequently. *Symptoms:* Cephalhematoma is seldom present at birth but appears two or three days later. The overlying skin is not discolored. The tumor may be of any size up to that of an apple. Fluctuation is present; the limitation of the mass by

sutures gives it a bony outline. This affection must not be confounded with traumatic hemorrhage in the same locality which occurs occasionally as a result of forceps delivery. Here the swelling is diffuse and is not limited by the sutures. *Frequency:* The frequency with which cephalhematoma occurs is about once in two hundred labors. *Course:* The cause of this affection is obscure and the factors which obtain in caput succedaneum are not in evidence here. It has even been found in breech presentations. The course is, on the whole, benign, and the tendency is to self-limitation. The swelling usually persists for a month or more. Occasionally infection of the blood-clots occurs and perhaps caries of the bone. *Diagnosis:* Cephalhematoma appears several days after birth as a bloody tumor underneath the pericranium, generally on the side of the head, and, as a rule, is due to pressure. Caput succedaneum is present at birth as a serous infiltration in the tissues over the pericranium and over the presenting part and is due to lack of pressure. It is soft but does not fluctuate. Cephalhematoma has a soft, cystic feel, but later becomes crepitant. It exists for one or two weeks and sometimes breaks down and suppurates. Caput succedaneum

FIG. 1028.—SINGLE CEPHALHEMATOMA. (*Author's case at Manhattan Maternity.*)

FIG. 1029.—TRIPLE CEPHALHEMATOMA. (*Author's case at Manhattan Maternity.*)

lasts only two or three days, after which it disappears. Besides these two forms of tumor found on the head of the newly born child several others may be mentioned, the possibility of the existence of which at times complicates the diagnosis, viz.: herniæ cerebri, vascular tumors, meningocele, encephalocele, and hydrencephalocele. These abnormalities have been noted elsewhere. (See page 265.) Meningocele consists of a tumor of the scalp partly formed by the meninges; encephalocele is made up partly of brain substance; while hydrencephalocele contains in addition a little liquid. (See page 265.) *Treatment:* Absorption of the extravasated blood may be hastened by the use locally of iodine, and by compression. It is not advisable to open the cavity unless an abscess forms. The blood might possibly be aspirated to relieve the dangerous tension of the scalp and pressure on the skull. In many cephalhematomata seen in hospital and private practice, in only one was an incision demanded; in this case, in private practice, a child of a primipara with a generally contracted pelvis after a thirty-six-hour labor and a difficult forceps extraction developed an enormous blood tumor. The tumor showed signs of sloughing and was freely

incised, the fluid blood washed out with saline solution, and a gauze drain inserted. A rather tedious recovery resulted.

6. Hematoma of the Sternomastoid; Caput Obstipum.—Traumatic hemorrhage intra partum into the substance of the sternomastoid of one or both sides has been noted in connection with both forceps and breech deliveries and after over-rotation. The extravasated blood sets up a myositis, and in time the phenomenon known as wryneck or caput obstipum may result. This hypothesis as to the origin of the deformity, however, is repudiated by many, but there is no doubt that the patient may have a transitory wryneck. The blood is absorbed in the course of several months, and in many cases is known to leave no deformity behind. This lesion may readily be mistaken for an enlarged lymph-node, being most commonly about the size and shape of a pigeon's egg. No treatment is required, least of all surgical intervention.

7. Aspiration Pneumonia.—The records of autopsies upon the newly born appear to show that a certain number of deaths are due to catarrhal pneumonia which develops within two days after delivery. There is no evidence to show that this condition can originate ante partum, nor that it ever arises from atelectasis or infection. On the other hand, there is little doubt that it is due to no other cause than the irritating effects of aspirated amniotic fluid which was sterile at the time of the accident. This aspiration indicates that the fetus has attempted to respire *in utero* during the act of labor as a result of temporary oxygen hunger. The aspirated fluids do not appear to produce the pneumonic state at the time of occurrence, for the child is usually healthy at birth, and perhaps for some time afterward. The supervention of the disease is then announced by rapid respiration, cyanosis, fever, and cough. Death probably occurs as a rule, although percentages are wanting. It is known that recovery is possible and that the child may be free from symptoms in the course of a week or ten days. *Diagnosis:* This is attended with great difficulty. Aspiration pneumonia has not been recognized as a clinical entity until recently. It will be necessary to exclude a number of other conditions, which would be almost impossible without autopsy. If the child is of normal development, without evidences of septic infection, and especially if there is a history of dystocia with evidences of temporary intra-partum asphyxia, the presence of the symptoms just narrated will make the diagnosis of aspiration pneumonia very probable. *Treatment:* The infant, since it cannot nurse, must be fed by stomach-tube or medicine-dropper, and must receive stimulants The general management corresponds largely to that of similar cases in older children.

4. INTRA-PARTUM INFECTION.

1. Ophthalmia Neonatorum.—This term is applied to a form of acute conjunctivitis occurring in infants and first manifesting itself within a period of from two to five days of birth. It has been customary to describe at least two varieties of the disease: (1) one of which, of no great importance, may be called catarrhal, and (2) the other, purulent, fraught with the greatest danger of serious injury to the eye, the cornea, and consequently to sight.

Etiology.—(1) A mild or a moderate catarrhal ophthalmia in an infant may be caused by any non-specific irritant, such as ordinary vaginal secretion, the use of soap or antiseptics, too much exposure to strong light, and also the prophylactic use of antiseptics in the conjunctival sac, notably silver nitrate. (2) The exciting cause of the second variety of the disease is infection, and infection with the gonococcus alone or mixed with other pathogenic micro-organ-

isms which have reached the eyes, during or immediately after parturition, from the maternal passages or from the hands or instruments of the physician. There is now no doubt of the causative relation of the gonococcus, which has been proved by numerous experiments both by culture and by inoculation. It is possible that the infection sometimes occurs when the eyes are first washed and not during parturition, and it is, of course, possible to infect the eyes of an infant with the gonorrheal virus in the same ways that the eyes of an adult are infected, but this would not be strictly ophthalmia neonatorum and might occur at any time. In the milder cases the gonococcus is not found and the condition must be attributed to infection with other pyogenic germs. The proportion of cases in which the gonococcus is found has been estimated at about 36 per cent. (Bartley).

Symptoms.—(1) Catarrhal ophthalmia could be dismissed in a very few words were it not for the fact that many of the specific cases are, in the beginning, deceptively like those belonging to the mild category, so that it is safer to regard all with suspicion and treat them like commencing purulent cases. In those cases which are really catarrhal the inner surface of the lids is congested and red and there is a serous or sero-mucous discharge, but the lids are not swollen and there is no tendency for the symptoms to get worse rapidly. Pathologically, the condition is one of acute, non-specific, catarrhal inflammation, and it tends to subside without causing structural change or necrosis in the mucous membrane. Bacteria may sometimes be present, but never the gonococcus. The symptoms are rarely severe and usually yield promptly to treatment.

(2) The symptoms of purulent ophthalmia appear, as a rule, on the third day after birth, sometimes a little later, unless the infection has occurred after delivery, when they appear at any time. The first signs are redness and œdema of the lids, the latter increasing so much that it becomes difficult for the nurse to separate the lids. The conjunctiva of the lids becomes very greatly swollen and congested, and has a granular or uneven surface, due to the great exudation of inflammatory products into the loose connective tissue. Very soon the conjunctiva of the eyeball itself is involved and becomes swollen in the same way, a condition called chemosis, and the cornea appears to be at the bottom of a cavity formed by the swollen edges of this ocular conjunctiva. The discharge at this stage is serous, or more often sero-sanguinolent. In very severe cases the exudate may be so great that the conjunctival vessels are compressed and the conjunctiva, instead of appearing red, looks grayish or yellowish-pink. A very free secretion of pus soon begins and the intense swelling and œdema may diminish to a certain extent. The pus may flow freely from the palpebral fissure, or the edges of the lids may adhere to each other, thus allowing the conjunctival sac to be ballooned out by the accumulation of the secretion. This stage of the disease is the most dangerous for the nurses and attendants, and the condition just described should be specially guarded against, since the pus is under considerable tension and may fly into the faces of the bystanders when it is suddenly released by the partial or complete separation of the lids. The most serious complication which may occur in the disease is involvement of the cornea, more often observed in adults, but still common enough in infants Destruction of this membrane of course means blindness, and it is estimated that at least 20 per cent. of all the blindness in the world is due to involvement of the cornea in this form of ophthalmia. The severer the infection, of course, the greater the danger of damage in this respect. The first sign of impending trouble is an appearance of dullness and cloudiness of the whole or a part of the corneal surface. The cloudy patches soon become distinct gray areas of

infiltration which later turn yellow and ulcerate. The ulcers may perforate into the anterior chamber or they may spread without perforation, the former being the course with the best prognosis. If there is marginal infiltration around the whole cornea, the so-called annular abscess is very likely to result, and in that event the cornea will be destroyed, with perhaps pan-ophthalmitis later. This means loss of the eye. In general, it may be said that the more pronounced the chemosis, the greater the danger that the cornea will be involved in the infectious process. Fortunately in infants, with proper measures, the danger of serious damage is not great. When the disease progresses favorably, the swelling, redness, and purulent discharge gradually diminish, and finally the lids reach a normal condition, though several weeks may be required for this. In infants there is rarely any tendency for the inflammation to persist and become chronic. A febrile movement is often present and evidences of systemic gonococcus infection may occur; acute inflammation of the joints has been observed.

Diagnosis.—This should present no difficulties except in the beginning of the attack, and in doubtful cases it is wise to be upon the safe side and treat the case as one of specific ophthalmia. The profuse purulent secretion and swelling of the lids are characteristic. The history of the mother may be of assistance, and an attempt should be made to confirm the diagnosis by microscopic examination of both maternal and fetal secretions.

Prognosis.—In a large proportion of the cases that do not receive prompt and intelligent treatment the sight is destroyed. It has been estimated before the general adoption of prophylactic measures that from 26 to 30 per cent. of all the cases of total blindness in adults was the result of purulent ophthalmia of the newly born.

Treatment.—(1) *Catarrhal:* The treatment of catarrhal conjunctivitis consists in cleanliness and protection from light. A solution of borate of sodium, ten grains to the ounce of camphor water, or a solution of boric acid, may be used frequently as an eye-wash, and it is a good plan to keep the edges of the lids from adhering by using a little boric-acid ointment upon them. The eyelids must be kept free from dried secretions by some such means, and it is better to make the manipulations at regular intervals, longer or shorter as the case is mild or severe, so that the child will rest without being interfered with needlessly. The condition is one which, as a rule, responds very promptly to treatment. (2) *Purulent:* The treatment of purulent ophthalmia neonatorum resolves itself into two parts: namely, (1) prophylactic and (2) curative.

(1) *Prophylaxis.*—What is as important in this matter as treatment is prophylaxis, and no measure should be neglected which can assist in preventing the occurrence of the disease. When the maternal passages are suspected, a preliminary course of antiseptic treatment should be instituted, beginning about two weeks before delivery. This should consist in daily or twice daily vaginal douching, first with a mild alkaline solution and then with one of bichloride of mercury, strength 1 : 5000. Just before delivery something must be done to provide a substitute for the normal lubricating mucus which will have been washed away by the douching process, and a 1 per cent. lysol solution will be found useful for this purpose. The vagina may be washed out with it when labor begins. As soon as the child is born its face must be carefully washed, special attention being given to the eyes, and even when infection is not suspected one or two drops of a 1 per cent. silver-nitrate solution should be dropped into each conjunctival sac. This may be washed away in a moment or two with salt solution if desired. It has now become with most obstetricians in maternity

service a matter of routine practice to use this 1 per cent. solution in the eyes of all infants, and since the method was introduced the number of cases of ophthalmia neonatorum has decreased enormously. As an illustration, we may cite the experience of Credé, who suggested the method. At his Lying-in Asylum, at Leipsic, before the use of silver nitrate, this form of ophthalmia occurred in 10.8 per cent. of all infants; after the treatment was systematically carried out the percentage fell to 0.1 or 0.2 per cent. Other similar experiences have been reported. The methods of procedure will almost invariably cure or protect the infant from this infection, but we have the further duty of protecting nurses, relatives, and physicians. It is hardly necessary to point out the extremely infectious character of the discharge from the eyes of a patient with gonorrheal ophthalmia or to emphasize the importance of avoiding the chance of infecting a clean eye. Every case should be promptly isolated and placed under the care of a special nurse. Attendants must be trained in the observance of antiseptic precautions, and no detail must be neglected. Cotton, gauze pads, and dressings should be burned after use, and the minutest care should be exercised to keep members of the family, especially children, away from the patient or anything which has been used about him. The patient himself must also be prevented from rubbing his eyes. If a clean eye should accidentally be brought in contact with infection, a few drops of the 2 per cent. silver-nitrate solution should be instilled, after the eye has been flushed with boric solution, and then cold applications should be made for two or three hours. After this a boric-acid wash should be used occasionally. The duration of this form of conjunctivitis may be several weeks, and treatment must be kept up according to the symptoms as long as they exist. If corneal infection occurs, it is a good plan whenever possible to get the assistance of an ophthalmologist, since there are often many details which can best be handled by the specialist.

(2) *Curative.*—To cure a patient, the sooner the disease is attacked, the better is the chance of prompt success. For at least a century silver nitrate in solutions of varying strength has been the mainstay in the treatment of all forms of conjunctivitis, and in 1882 Credé proposed its use as a prophylactic in infants. When the disease is already present, active treatment must be at once instituted, and what we must depend upon chiefly is antisepsis and local cold. The lids and the conjunctival sac must be kept free from accumulated pus and some kind of antiseptic must be applied to their surfaces. Often cold must be applied continuously if we are to expect success. During the first three or four days before the discharge becomes purulent, cold compresses must be applied continuously for an hour twice or three times a day and free washing of the conjunctival sac should be done in addition four or five times a day with a warm, saturated boric-acid solution or a 1 : 2000 potassium permanganate or a 1 : 10,000 sublimate solution. This is of the greatest importance, and the washings should be frequent enough to keep the eyes clear of pus. An eye-dropper, glass syringe, or absorbent cotton dipped in the cleansing solution can conveniently be used (Fig. 1030). The child on its side should be held on a piece of rubber on a nurse's lap and the lower eye gently irrigated, the solution being first used to wash away secretion from the outside of the lids, and then gently from between the lids, enough force only being used to wash away the discharge and cleanse the conjunctival surface. In addition to this, it is a good plan to instil once a day a few drops of a 10 per cent. protargol solution (Fig. 628). It is not necessary to use silver nitrate at this stage, and mercury bichloride will be found too irritating in solutions of sufficient strength to exercise active antiseptic

properties. If the case under observation should turn out to be simply an aggravated instance of catarrhal ophthalmia, this treatment will be found sufficient; but if pus begins to form and all the symptoms increase, and also if the gonococcus can be demonstrated, we must change our treatment to some extent. The conjunctival sac must be cleansed much more frequently, at least every hour during the day, but perhaps not so often at night, and the lids must be kept from sticking together by the method already described. The protargol solution must be increased in strength to 20 per cent. and it may be used more frequently, preferably after the discharge has been thoroughly washed away and the shreds of muco-pus carefully brushed from the conjunctiva with bits of cotton or gauze. If the action of the protargol does not seem to be favorable, it will occasionally be found advisable to employ a 2 per cent. or even stronger silver-nitrate solution, but it is better under such circumstances to make the application only to the everted lids and to wash the residue away at once with salt solution. The extent of the use of cold applications depends somewhat upon the intensity of the inflammation, but in all cases ranging from severe to bad, this must practically be continuous. This involves unremitting care on the part of the nurse, who will require rather frequent relief. The best method to pursue is to have a block of ice in the room and to prepare a number of soft gauze pads about an inch or an inch and a half in diameter, which can be placed on the ice and thus allowed to become moist and cold. These can be used as often as necessary and must be changed as soon as they become warmed. Not infrequently it is necessary to place a fresh pad on each eye every minute, at the same time that the antiseptic treatment is being kept up. In cases of corneal involvement atropin must be used to dilate the pupil, and in all bad cases its use is a wise precaution. If there seems to be danger of strangulation of the corneal vessels on account of the density of the exudate and consequent interference with the nutrition of the cornea, hot applications may be substituted for cold for a time so as to stimulate the circulation and absorption. It is also occasionally necessary to make radial incisions in the swollen con-

FIG. 1030.—METHOD OF IRRIGATING THE EYE OF THE INFANT IN CASES OF OPHTHALMIA NEONATORUM.

junctiva in order to relieve the external tension. It is better not to use the stronger solutions of silver nitrate and protargol more than once a day. In the case of weak infants care must be taken not to disturb the child any oftener than is absolutely necessary, for a certain amount of undisturbed rest is essential and must be allowed, even if we are not able to cleanse the lids quite as often as we should otherwise wish. The child must be kept warm and carefully and regularly fed, and any gastro-intestinal disturbance must receive prompt attention. In a few very severe cases the swelling and chemosis may be so great that a short incision may have to be made in order to relieve tension and give access to the conjunctival sac. When such measures are thought necessary, no hesitation need be felt in calling upon the expert ophthalmologist for assistance. Sometimes a certain amount of chronic inflammation remains after the acute symptoms have subsided. This may be treated by daily applications of a 1 per cent. protargol or a 0.5 per cent. zinc sulphate solution.

Expert Advice.—In view of the danger of loss of sight from this disease and the responsibility involved, it is always well for the obstetrician or general practitioner to secure the services of an expert ophthalmologist, if possible, in every case of the purulent disease.

2. Gonorrheal Stomatitis.—A gonorrheal infection in infants has its origin in the genital tract of the mother, and for that reason it is confined almost entirely to the newly born. *Etiology:* The delicate mucous membrane of the newly born child offers little resistance to this infection, especially after improper efforts have been made to cleanse the mouth, and any abrasion offers a favorable entrance for the gonococcus. A pre-existing or concomitant ophthalmia explains the origin of many cases. *Pathology:* The hyperemia of the acute stage of inflammation is followed by the formation of creamy patches upon the hard palate or tongue. But the process is distinctly local and shows no tendency to affect the entire stomal mucous membrane. There is a possibility, however, of an added infection due to staphylococci or streptococci resulting in pathological conditions more serious in character. *Symptoms and diagnosis:* With stomatitis of this character alone, constitutional symptoms are usually absent, and the general health is not particularly affected. Microscopic examination of the exudate reveals the nature of the exciting cause. *Treatment:* A saturated solution of boric acid frequently applied is a most efficient agent. In more severe cases a mixture of boric-acid solution and hydrogen peroxide is very useful. The solid stick of silver nitrate may also be of service.

IV. DISEASES INCIDENT TO CHANGE OF ENVIRONMENT.

1. Primary Asphyxia of the Newly Born. 2. Atelectasis Neonatorum. 3. Failure of Circulation. 4. Œdema Neonatorum. 5. Failure of Digestion and Assimilation. Inanition. 6. Inanition Fever.

The fetus at birth not only changes its surroundings from an aqueous to an aerial medium, but begins to use hitherto quiescent organs and to disuse others previously active. Naturally a healthy child should encounter little or no difficulty in this physiological readjustment; but it is otherwise with the premature or undeveloped. Nearly every one of the more important functions may be in abeyance as a result of this congenital debility. The lungs may not expand, the heart's action may fail, the stomach may be unable to retain the ingesta, assimilation may be impossible, etc. Mere functional incapacity may be associated with various affections largely peculiar to this period of life,

and believed to be the expression of incapacity of the fetus to adapt itself to the external world. These affections do not appear to date from fetal life, nor have they been brought into connection with any form of infection post partum. They are not hereditary, and hence they may be regarded as due to a "change of life," just as puberty and the climacteric have their own peculiar disorders.

1. **Primary Asphyxia of the Newly Born.**—This term is applied to the following condition: When an infant delivered without dystocia, and with no symptoms which point to subaeration ante partum or intra partum (livid or pallid hue, anomalies of the circulation, etc.), fails to respire as soon as the cord is cut, we have a state entirely distinct from the ordinary type of asphyxia which accompanies dystocia. In some instances these infants do breathe for a short time, or the failure of respiration may not set in until several days have elapsed. This affection is purely an anomaly of readjustment of the infant to its new environment and therefore to be met with, as a rule, in weak and premature infants. It should be carefully distinguished from conditions due to labor itself—for example, pneumonia due to aspiration of amniotic fluid; and also from the so-called spurious asphyxia in which the respirations are so shallow that they pass unnoticed. It must also be borne in mind that while many cases of primary asphyxia of the newly born are due to simple failure of the lungs to expand, others are rendered possible by the presence of disease or malformation of fetal origin (syphilis of the lungs, hydrothorax, defects of the diaphragm, etc.). The mechanism of these cases is not difficult to understand. Neither the lung tissue nor the parietes of the chest are sufficiently developed for respiration, and when malformations or diseases are present, the mechanical hindrance is also capable of accounting for the failure of respiration. The thorax of the premature child may undergo rhythmic movements (this is said to occur even *in utero*) without any corresponding inflation of the lung. For all practical purposes the remainder of this subject may be considered under Prematurity and Asphyxia Intra Partum.

2. **Atelectasis.**—In the healthy infant born under favorable circumstances, the function of respiration is established in the first minute of life, a few vigorous cries expanding the lungs freely. In other infants, however. the lungs do not undergo inflation, or only a portion of the upper lobes is inflated while the remainder of the organs does not change from the fetal state. This is termed *congenital atelectasis.* While atelectasis may occur without causing asphyxia, and while the latter may not be due necessarily to inability of the lungs to inflate, in the majority of cases the two conditions must necessarily coexist. The lungs of a healthy infant expand as soon as the cord is cut, but in the weak or premature a certain portion fails to become aerated. The child may be threatened with death from asphyxia, and the application of the usual management for that condition may reanimate it. The atelectatic area, however, may still persist and threaten the child's life during the ensuing hours or days. If the newly born has not succeeded in breathing at all and has succumbed at once to asphyxia, the atelectasis is of course absolute. But if, as often happens, respiration has been inaugurated either spontaneously or as a result of treatment, some of the lung tissue—as a rule, both upper lobes—is not only inflated but emphysematous, the rest remaining in the fetal state. If the child survives, air begins to enter the posterior aspect of the lower lobes. The central portion of the lungs is the last to yield. Despite the apparent solidity of the atelectatic tissue, it may readily be inflated artificially even months after birth. When these children do not succumb at birth they simply present the picture of debility or pre-

maturity and are menaced by death in various forms (marasmus, convulsions, etc.). If they are doomed to perish of asphyxia, cyanosis gradually develops. The prognosis, however, is not hopeless, as many of these children survive.

Etiology.—Abnormal conformations in the respiratory tract are rare, so that practically it may be said that atelectasis is due primarily to feeble respiration following some injury to the centers in the brain from prolonged labor or instrumental delivery. Atelectasis may occur, however, in infants whose respirations are apparently normal in rhythm but not sufficiently full and forcible to cause complete pulmonary expansion.

Pathology.—The conditions found at autopsy depend upon whether the child lived a few days or longer. In the newly born both lungs are generally involved. The anterior borders of the upper lobes are inflated and light pink in color and emphysematous from the added strain thrown upon them; while the rest of the lung is in the fetal state, dark brownish in color, not inflated, and firm to the touch. In older infants the posterior parts of the lower lobes are found not inflated or only superficially so, the central portion of the lobes being of no service in the act of respiration. Incidentally there may be found various degrees of congestion of the liver, spleen, stomach, and intestines, due directly to the imperfect pulmonary circulation.

Symptoms.—In infants with a history of asphyxia at birth atelectasis is most noticeable. They gain little in weight, the circulation is poor, the extremities are cold, they cry feebly if at all, and do not take nourishment well. In some cases death occurs in a few days, while others live for weeks and months. Cyanosis may develop at any time and death follow from asphyxia or convulsions. Many infants, however, who begin life most unpromisingly gain steadily under favorable conditions and recover completely.

Diagnosis.—The general condition of the infant gives far more information than does physical examination of the chest. Owing to the fact that both lungs are generally involved, the ordinary advantage of comparing the two sides of the chest is lost; but if it happens that one lung only is the seat of the trouble, we may find the respiratory murmur feebler over that portion of the chest. Cyanosis or convulsions in the very young should always suggest the possibility of atelectasis.

Treatment.—If a vigorous cry does not occur spontaneously at birth, the use of the hot and cold bath should be resorted to. Spanking is often effective and should be repeated at regular intervals if necessary. In those prematurely born careful attention should be directed to regulating the body temperature by the use of cotton, hot baths, or an incubator. Friction and gentle massage are of value in some cases. If convulsions or asphyxia develop, the hot bath offers the greatest hope of benefit.

3. Failure of Circulation.—The various malformations of the heart are sometimes of such a degree that death results in the neonatal period. In the milder varieties the duration of survival may be indefinite. These anomalies give rise to cyanosis. Some debilitated infants appear to succumb to simple arrest of the circulation. The condition known as œdema neonatorum is probably associated with a feeble right heart, with overfilling of the venous circulation.

4. Œdema Neonatorum.—The œdema appears in various superficial localities and in some cases general anasarca may develop; the serous cavities, however, are rarely involved. Unless the infant dies as a result of disability, the œdema may disappear within a few days. Relapses are frequent. In sclerema neonatorum failure of the circulation is one of the most striking symptoms, although it cannot be set down as the cause of the affection.

5. Failure of Digestion and Assimilation.—*Marasmus* as ordinarily described is a condition which develops after the neonatal period and extends over a considerable period of time (see page 840). An analogous condition of the newly born, which, however, leads much more rapidly to death, is generally known as *inanition.* A peculiar phenomenon connected with starvation in the newly born is a rise of temperature (hyperpyrexia neonatorum). According to Holt, however, the trouble in these cases may lie entirely with the mother, whose breasts are dry. Children who are born healthy, if they obtain no milk by the third or fourth day of life, show the commencement of inanition by a rise of temperature to 101° F. or upward, which subsides as soon as the child is fed. Inanition which is the fault of the child may be due to refusal of the breast or of food, or to absolute inability to nurse or to retain the milk, or, finally, to inability to digest and assimilate it. These causes are all operative in weak and premature infants at birth. Naturally the various phenomena of prematurity or debility coexist, so that it is difficult to assign particular symptoms to inanition. The exhaustion and debility are accentuated and the child's life is rapidly forfeited, sometimes in two or three days. In cases in which some nourishment is taken gain in weight is a good sign, and vomiting is a bad one. The management of these cases is necessarily included under that of "prematurity" and "congenital debility." Refusal of food is met by gavage. If vomiting is present, the milk thus given should be diluted or an attempt should be made to find something which the stomach will tolerate. (Compare Inanition, page 840.)

6. Inanition Fever.—It was formerly supposed that inanition fever did not occur as a distinct condition, but observations during the past ten years prove it to be comparatively frequent, especially from the second to the fifth day. It is really due to starvation, the infant being unable to obtain the proper amount of nourishment from the breast as a result of limited or negative supply of milk, of depressed nipples, or of inflammatory conditions. It is not confined to premature or delicate infants, but occurs quite as frequently in those ordinarily vigorous. Fever is the most important symptom; it ranges from 102° to 105° F., and generally reaches its highest point on the third or fourth day of life. The infants lose weight rapidly, not infrequently eight ounces in twenty-four hours, and the condition is one that quickly causes alarm. Various other symptoms accompany the fever and loss of weight. A certain number of cases are fretful and restless, while others show hot, dry skin, extreme irritability, and much prostration. When all other causes of fever can be excluded, and investigation proves that the proper amount of nourishment has not been taken by the infant, the case may be called "inanition fever." Treatment consists in the administration of water at regular intervals until thirst is alleviated and the temperature falls. If necessary, a wet-nurse should be secured or artificial feeding begun.

V. DISEASES DUE TO BACTERIA AND FUNGI.

1. Umbilical Sepsis. 2. Septic Coryza. 3. Septic Pneumonia. 4. Gastro-intestinal Sepsis. (1) Ulcerative Stomatitis. (2) Gangrenous Stomatitis. (3) Parotitis. (4) Retropharyngeal Abscess. (5) Gastro-enteritis. 5. Cutaneous Sepsis. (1) Dermatitis ex-foliativa neonatorum (Ritter's Disease). (2) Pemphigus acutus neonatorum. Septic Pemphigus. (3) Impetigo contagiosa neonatorum (Periumbilical Pemphigus). (4) Ecthyma neonatorum. (5) Multiple Abscess. (6) Erysipelas. 6. Tetanus. 7. Aphthæ. 8. Thrush.

The newly born infant may be attacked by the omnipresent pathogenic bacteria, which may cause infection at the navel, in the mouth, or the gastro-enteric

tract, etc.; also by fungi. The principal members of this group are sepsis in its manifold aspects, trismus, aphthæ, etc. The bacteria which are pathogenic to the newly born include the ordinary exciters of suppuration (streptococci and staphylococci), the germs of tetanus and erysipelas, and to a certain extent any virulent micro-organism which may cause chance infection. The newly born enjoys a relative immunity from many infectious diseases, and, generally speaking, only those bacteria need be discussed which show a particular tendency to attack the infant as it emerges into the world. The gonococcus, since it menaces the unborn child, is placed among the causes of intra-partum diseases. Of fungi which tend especially to attack the newly born, it will be sufficient to mention those which cause aphthous stomatitis and thrush.

Septic Infection.—*General Remarks.*—By septic infection in the newly born must be understood a systemic disease which takes the form of an extremely severe infectious process, begins usually at the navel, and later involves in a greater or less degree other parts of the body. It is one of the most dreaded affections of early life.

Frequency.—When proper aseptic and antiseptic precautions enter into the details of delivery and care of the newly born, few cases of septic infection follow. The great majority of cases are referred to influences which seem to be present and to flourish at intervals in lying-in hospitals or wherever puerperal infection finds a harbor. It naturally is more common in those localities and among those people who do not enjoy the blessings of modern obstetrical attendance, though it has also its victims among the best classes of society.

Pathology.—In eight cases out of ten the process begins in the umbilical vessels or in the connective tissue about the navel; the blood-clots in the vessels and the clean-cut edges of the stump offering good soil for bacterial development. Injuries or abrasions of the skin and mucous membranes and of the conjunctiva offer other avenues of entrance. The precise manner of communication in these cases is obscure, but careful search will reveal in the majority of cases the place of infection, because the bacteria which are the real cause of the disease must have penetrated into the body from the external world. When it is once in the system, it can be disseminated through various channels. It may be carried by the lymphatics into the general circulation or a purulent phlebitis may be excited at the point of infection, and this in turn may excite by embolism analogous lesions in other parts of the body. The most striking feature at autopsy is that there is never a lesion of one organ exclusively. Several or, it may be, almost all the organs and systems exhibit foci of disease.

Symptoms.—These usually begin in the first week, never later than the twelfth day—and are those of a general septic poisoning with the local manifestations at the point of entrance. The fever is characteristically irregular. It may look like typhoid fever or so closely resemble quotidian or even tertian intermittent fever as to lead to a wrong diagnosis. Other cases show little or no elevation of temperature. Cutaneous symptoms, icterus, and either punctiform petechiæ or extensive hemorrhages are common. The pulse is generally rapid and of poor quality and the respiration is disturbed. Emaciation always occurs. The nervous symptoms are restlessness, irritability, and muscular twitchings, with stupor or convulsions in the later stages. The abdomen is generally swollen and tender, and we are able at times, by pressing along the abdominal walls toward the umbilicus, to squeeze out a few drops of purulent material. The spleen may be enlarged and palpable. There are sometimes severe intestinal symptoms, a septic diarrhea with greenish or dark or bloody stools of a very foul odor. The inflammatory processes in the brain, lungs, and heart often fail to give well-defined symptoms.

Diagnosis.—The diagnosis of septic infection is not difficult in well-marked cases, particularly if the mother develops puerperal septicemia. It is more difficult in isolated cases in which no entrance for bacteria can be discovered, when the symptoms are ill defined, and when the child comes under observation late with an imperfect history. Inflammation of the nose, eye, or joints should suggest the possibilities of the case, the importance of not regarding any single local process as the whole cause of the illness being borne in mind.

Prognosis.—This should be guarded even in the milder forms. The severe cases are generally fatal, owing to the feeble resistant power of the infant.

Treatment.—In the entire subject of septic infection nothing is so important as the means employed for its prevention. Antisepsis in its relation to delivery and the care of the infant is capable of preventing the disease. It is the duty of the physician to carry out the strictest antiseptic details in every case of labor. The utmost aseptic care must be observed in ligating the cord and in dressing it. When infection occurs, the infant should be isolated at once. Since there is no specific for septic infection the remedial treatment can only be symptomatic. The inflammatory processes within the body cannot be attacked directly, and medicinal methods are resolved into proper feeding and necessary stimulation. External suppurative processes require surgical procedure.

1. Umbilical Sepsis.—This variety represents the type of sepsis neonatorum, and perhaps four-fifths of the clinical material. The cord may be infected either at the time of ligation or afterward during the sloughing and healing periods. Contaminated ligature material and dressings are chiefly responsible for infection, but after the stump of the cord has fallen the often immature scar is still exposed to the action of pathogenic germs. Before sloughing, the arteries, veins, and lymphatics are all capable of absorption, but afterward the vein alone, which often retains some of its lumen for a considerable period, is held to be responsible for infection. The subject of umbilical sepsis is one of extreme perplexity. The local lesions exhibit the greatest divergence of type. While in one series of cases arteritis predominates, a second reporter finds hardly any lesion but phlebitis, and a third finds more lymphangitis than either of the other lesions. The same absence of law is seen in the consecutive lesions. In some cases the local lesions, of whatever nature and severity, remain localized throughout. In other cases generalization occurs, sometimes rapid and fatal, at other times more deliberate and less malignant. The following classification of umbilical sepsis is now recognized at the Tarnier Clinique (Paris): (1) Infection of the cord proper. This occurs only in putrefaction of the stump. (2) Infection of the granulation tissue of the wound after detachment of the stump. This occurs when for some reason the cicatrization is not complete. A minute wound is left which suppurates and sometimes produces excessive granulations. The discharge may be considerable, and is then known as blennorrhea of the umbilicus; when the granulations attain a large size, they are known as umbilical fungus. (3) Infection of the periumbilical tissues (skin, subcutaneous tissue, lymphatics, etc.). This is manifested by erysipelas or lymphangitis, with or without abscess formation. In rare cases gangrene occurs, with the formation of the so-called umbilical ulcer of former days. Another type of local infection is periumbilical pemphigus. (See Sepsis of the Skin.) Phlegmon of the periumbilical region is indicated by the formation of an indurated mass about the cord. Suppuration does not occur invariably, although abscess-formation and sloughing form the usual termination. All the preceding forms of sepsis are purely local; and in order that general infection should occur, it is necessary for the vessels of the cord to be involved. Hence

the final type: (4) Infection of the umbilical vessels. This is able to occur with or without local mischief. The microorganisms may enter the circulation immediately and set up fatal sepsis. It is possible that a very slight, transitory local reaction always occurs, but it is frequently impossible to demonstrate its existence.

Treatment.—Local sepsis is managed on ordinary surgical antiseptic principles. Exuberant granulations should be touched with tincture of iodine or nitrate of silver. Accumulations of pus should be evacuated and pyogenic surfaces irrigated. For an ordinary dressing an antiseptic powder (boric acid) may be used. In the more severe types ichthyol, 50 per cent., is recommended.

2. Septic Coryza.—The coryza of the newly born is not necessarily due to exposure. According to Bar, it is frequently encountered in children who have been exposed to the contact of septic amniotic fluid. Despite its infectious character, it is essentially a benign and self-limited affection, and only exceptionally does the inflammatory process invade the sinuses and middle ear. It has recently been claimed that many children are born with adenoids, and that this condition is manifested by a coryza neonatorum. The treatment is carried out along the same lines as that in older individuals. At the Tarnier Clinique mentholized oil is applied by a post-nasal tube of special pattern.

3. Septic Pneumonia.—The subject of pneumonia during the first few days of life is one of great obscurity, and doubtless comprises several quite distinct conditions: (1) In aspiration-pneumonia, which is a simple catarrhal process, it is conceivable that the amniotic fluid aspirated intra partum might be septic and thereby directly infect the bronchi with streptococci, etc. When Bar states that infectious pneumonia is often seen after a child has breathed *in utero*, he alludes to a condition which is by no means necessarily septic. (See Aspiration-pneumonia.) The course of this affection as described by Bar is that of this simple irritant type. (2) Since bronchopneumonia is a deadly foe of infancy in general, it is more than likely that many cases in the newly born are derived in the ordinary way, from epidemic influence, and do not represent a type of neonatal disease. (3) Holt and other pediatrists describe a well-marked form of septic purulent pleuropneumonia which is not recognizable during life. Since it often accompanies sepsis in other localities, it doubtless represents a phenomenon of general infection, and corresponds to the purulent pleurisy of the newly born described by Bar.

4. Gastro-intestinal Sepsis.—Some of these infections may date from the ante partum or intra partum period, as when the fetus swallows septic amniotic fluid. The cause most in evidence after delivery would be nursing an infected nipple or contact of the mouth with some unclean object. Some of the expressions of this sepsis of buccal origin are as follows:

(1) Ulcerous Stomatitis.—This condition is usually due to the streptococcus, and has received numerous designations. It appears in the form of multiple plaques of a grayish hue representing a diphtheroid false membrane, which when removed discloses ulcerated surfaces with sharply cut borders. Their number and site are often characteristic, there being two plaques seated symmetrically on the pterygoid border of the vault of the palate. In some cases they are seated about the frenula of the lips. The course pursued is usually benign, but erysipelas has sometimes been traced to the lesions.

(2) Gangrenous Stomatitis (Cancrum Oris, Noma).—This disease is rare. It occurs also in other situations besides the mouth, such as the female genitals, the nose, and the ear. It generally complicates some exhausting disease, such as measles, the child being always in a weakened condition. Every case must be isolated in order to avoid the spread of the disease.

(3) Parotitis.—Both the parotid and the submaxillary glands have been infected apparently by the migration of pyogenic germs from the mouth along the excretory ducts. At first pus discharges by the latter structures, but in time these become clogged and incisions are necessitated.

(4) Retropharyngeal Abscess.—This affection, which, according to Bar, is often overlooked, occurs as a variety of buccal sepsis. On account of the resulting dysphagia the infant will perish unless relieved. There is also a marked constitutional reaction in these cases.

(5) Gastro-enteritis.—Of recent years severe streptococcus gastro-enteritis, followed perhaps by general sepsis, has been traced to nursing by the newly born from an infected breast. If the condition cannot be explained in this manner it may have been due possibly to intra-partum infection. The disease begins with vomiting and diarrhea, the ejected matter having a foul odor. If the infection is of a mild local type, the symptoms disappear within a few days. Otherwise we see persistent diarrhea develop, with inanition and evidences of systemic infection. If the infant continues to absorb pus from the infected breast, the chances of a severe type of infection are increased.

5. Cutaneous Sepsis.—(1) Dermatitis Exfoliativa Neonatorum (Ritter's Disease).—*Definition:* An exfoliative process in the skin of the newly born which is believed to bear the same relation to pemphigus neonatorum that exfoliative pemphigus bears to common pemphigus in adult life. *Etiology:* Ritter's disease is believed to be due entirely to septic infection of the child from the maternal passages, from midwives, etc. The ordinary exciters of suppuration may be cultivated from the skin. Quasi-epidemics have occurred. *Symptoms:* The affection usually begins about the mouth and extends over the entire surface. The skin becomes intensely red and desquamates in large, loose flakes, which tend to adhere to the bedding, etc. The temperature is subnormal. *Diagnosis:* There is no affection of the newly born which simulates Ritter's disease. *Prognosis:* About one-half the children recover. Relapses occur. *Treatment:* The continuous bath is indicated at first. If impracticable, alkaline lotions should be applied until desquamation ceases, and followed with ichthyol ointment.

(2) Pemphigus Acutus Neonatorum (Septic Pemphigus).—*Definition:* A bullous exanthem not necessarily the same as pemphigus in the adult. It corresponds to some extent with the bullous type of impetigo contagiosa. *Etiology:* Pemphigus of the newly born appears to be due to the ordinary exciters of suppuration, which may be cultivated from the fluid contents of the bullæ. The source of the disease may be the maternal passages, or other infants who have the same affection, etc. *Symptoms:* Within the first few days of extrauterine life bullæ make their appearance upon some portion of the integument and tend to involve the entire surface. The contents may be serous, purulent, or bloody. Numerous evidences of general sepsis may become apparent. *Diagnosis:* While a few other diseases of the newly born may present bullæ (syphilis, erysipelas), none should be confounded with pemphigus. *Prognosis:* This is unfavorable and worse in proportion to the amount of suppuration, hemorrhage, and constitutional disturbance. *Treatment:* The blebs should be evacuated, the surface cleansed, and ichthyol ointment (50 per cent.) applied. Measures must be directed against the constitutional infection.

(3) Impetigo Contagiosa Neonatorum (Periumbilical Pemphigus).—For a description of impetigo contagiosa as it occurs in older children the reader is referred to works on dermatology. While the newly born infant might exhibit the ordinary lesions of this disease if exposed in an epidemic, there is one individual phase which it alone exhibits: viz., the so-called periumbilical

pemphigus,—in reality a localized bullous form of impetigo contagiosa which begins about the navel during the first few days of life. Staphylococci have been cultivated from the contents of the blebs. This form of impetigo is probably due to a mild local infection, and in fact appears to differ only in degree from ordinary pemphigus neonatorum, which sometimes appears to start from the navel. Periumbilical pemphigus should be treated like the more generalized form of the disease.

(4) Ecthyma Neonatorum.—*Definition:* Like the preceding affections, ecthyma is a manifestation of sepsis of the newly born in which cutaneous lesions predominate. In the future all these affections will doubtless be regarded as types of one fundamental infection which may announce itself by various lesions, bullæ predominating in one case and pustules in another. It is at present impossible to state positively whether these eruptions originate in the skin or are preceded by a blood infection. Ecthymatous lesions of the newly born resemble those in the adult, and consist of large subepidermic pustules having a broad indurated base. At this period of life there is a special tendency for the pustule to ulcerate. In certain cases there is a marked inclination toward ulceration in depth (ecthyma terebrante). *Etiology:* The ordinary exciters of suppuration are usually at fault (staphylococci and streptococci); in particular instances some other germ, such as Bacillus pyocyaneus, may be responsible for the lesions. According to the obstetricians of the Paris clinics, this ecthyma occurs by preference in premature and congenitally feeble children, in the cachectic, etc. *Symptoms:* The lesions occur most frequently on the head, neck, and abdomen. When the process is at its height, they appear chiefly as ulcers with rounded borders surrounded by areas of a purple hue. The development of the pustules is preceded or accompanied by fever, vomiting, diarrhea, etc. A special localized form of this suppuration is sometimes seen about the nails of the newly born—the so-called "run round." *Diagnosis:* The recognition of the pustulo-ulcerous lesions of ecthyma is not difficult, and the real diagnostic difficulty lies in arriving at a knowledge of the predisposing cause; for clinically ecthyma, while technically a contagious disease, is rather the expression of an underlying cachectic state. *Treatment:* Measures must be directed to the general condition. If the patient presents crusted lesions, the scabs must be removed by sweet oil, etc. The exposed surface and ulcers in general should be treated with mild solutions of nitrate of silver.

(5) Multiple Abscesses.—Multiple abscesses in the newly born consist of collections of pus of varying size and depth beneath the skin. Two types occur: viz., the superficial or benign and the deep or septic. *Etiology:* The superficial or benign type of abscess appears to represent a local infection with the staphylococcus or streptococcus, which germs are often derived originally from some maternal lesion such as purulent mastitis. The deeper sort may form in the subcutaneous tissue or between contiguous muscles. In these cases the infectious pus appears to have been swallowed by the infant while nursing from an infected breast. Abscesses coexist in the large viscera, and the condition is really one of profound pyemia. *Symptoms:* These abscesses cause swellings which may be as small as a pea or as large as a small hen's egg. In the benign form the abscesses appear in crops, and are usually of small dimensions. The larger, more deeply placed abscesses of septic origin behave very much like ordinary cold abscesses. Their number and extent make the condition most serious, to say nothing of the great likelihood of the involvement of subjacent viscera. Bar speaks of opening forty-five of these abscesses in one child. Death finally occurred, and on autopsy a collection of pus was found in the posterior mediasti-

num. *Diagnosis:* This should readily be made with the exploring needle if any doubt arises as to the nature of the affection. *Treatment:* A newly born infant should never nurse from a breast the seat of abscess, or with any lesion whatever of the nipple, areola, or breast. If abscesses have formed, they should be evacuated, and the larger sort may require drainage. If the earliest abscesses are evacuated, irrigated with sublimate, and sealed with collodion, the spread of the disease may be partially checked.

(6) Erysipelas.—Erysipelas in the newly born, as in adults, is an inflammation of the skin due to a specific germ, Streptococcus erysipelatis. It is especially seen in the first two weeks of life, and usually has its origin in the navel, the small fissures of the anus, or abrasions of the skin. *Pathology:* The skin and subjacent connective tissue are congested and swollen and infiltrated with serum, fibrin, and leucocytes, the process continuing in many cases to suppuration, ulceration, and gangrene. Metastases may form in the lungs, heart, brain, kidney, and spleen. If the umbilicus is the primary seat, it is likely that localized or general peritonitis will follow. Acute degeneration of the liver and kidneys is a common step in the progress of the infection. *Symptoms:* Invasion is usually marked by vomiting, high fever, and severe prostration. Locally the skin is hot, dry, hyperemic, and tender, and the inflamed area rapidly increases in size. Restlessness and vomiting with the fever and prostration persist during the course of the disease, which in the newly born usually ends disastrously. Especially is the prognosis bad when the umbilicus is the starting-point. *Treatment:* Isolation should be practised at once. Locally an ointment of ichthyol, 10 to 20 per cent. in lanolin, should be applied continuously over the inflamed parts. If suppuration occurs, wet dressings of lysol, creolin, or bichloride may be of advantage. Constitutionally we must support the child with alcohol and strychnin in free doses and the regulated use of baths and packs. Artificial feeding may be required during the entire illness, particularly when there is any danger of infecting the mother's breasts.

6. Tetanus.—Tetanus is an acute infectious disease of rather infrequent occurrence, the main symptom of which is tonic spasm involving the muscles of the jaws and neck or the entire muscular system. There is no ground for establishing tetanus neonatorum as a distinct form, since its etiology and course are analogous at all times and at all ages. The specific cause is a bacillus which is rather widespread and in some places very abundant, occurring in the soil with other germs. It produces no special local lesion, but affects the body by its elaboration of tetano-toxin, a most virulent poison. The germ enters the body through abrasions and fresh-cut surfaces, more often through the umbilicus. *Pathology:* No characteristic lesions have been found in the spinal cord or brain. *Symptoms:* These may develop within a few days after inoculation or they may be deferred for one or two weeks. Ordinarily the first thing noticed is the infant's inability to nurse, due to rigidity of the muscles of the face and jaws and nape of the neck. This rigidity spreads by degrees to the muscles of the trunk and extremities. In many cases the continuous tonic spasm is occasionally interrupted by sudden and irregular paroxysms, during which all the affected muscles become still more tense and opisthotonos is pronounced. The jaws are firmly pressed together and can be opened but slightly. The face has a peculiar drawn painful expression, the respirations are embarrassed, the pulse is rapid and weak, and prostration is pronounced. Fever is generally present, often rising to 105° F. before death. Recovery sometimes occurs in the milder forms, but when the disease is once established the prognosis is bad. *Treatment:* Avoid infection by observing perfect aseptic precautions in the dressing

of the cord and the treatment of denuded surfaces. When systemic poisoning is evident, the point of entrance should be attacked and made as clean as possible. Antitoxin should be administered by the hypodermic method. Further than this we must rely upon the symptomatic remedies with the aim of preserving life. Remedies which lessen the irritability of the nervous centers, such as potassium bromide, gr. 4 to 8, every two hours; or chloral hydrate, gr. 2 to 4, every one or two hours per rectum, have a certain amount of value. Calabar bean has been much used in doses of gr. $\frac{1}{12}$ to $\frac{1}{8}$ several times daily by the hypodermic method. All unnecessary handling should be avoided and everything done to prevent disturbing the infant. Feeding by the nasal tube is necessary when the jaws cannot be forced apart, and stimulants may be given by the same channel. Spinal puncture has given good results.

DISEASES DUE TO FUNGI.

Although there is no positive proof that these conditions are due to fungi, still they are most conveniently classed here.

7. Aphthæ.—Aphthæ, sometimes called vesicular or follicular stomatitis, is a morbid condition of the mouth characterized in the early stages by the appearance of whitish vesicles followed by superficial ulcers, mostly on the inside of the lips and the edges of the tongue. It appears at any time in infancy, but infrequently in the newly born. Authorities tend to the belief that it is nervous in origin. So far there is no testimony to prove its bacterial origin. Probably in some instances the exciting cause is some derangement of the digestive organs which is not appreciable. *Treatment:* Prophylaxis consists in scrupulous cleanliness of the mouth, especially at the time of nursing. Cold water should be given freely. The mouth should be kept properly cleansed with solutions of boric acid or Dobell's solution. Powdered alum dusted on or the judicious use of solid alum or the solid stick of silver nitrate generally hastens the process of healing.

8. Thrush.—The term thrush signifies a form of inflammation of the buccal mucous membrane, the peculiar feature of which is the formation of curd-like points or patches on the parts involved. It occurs any time in the first few months of life. It has been definitely settled that Oidium albicans is not the cause, but another variety of fungus, parasitic in character, the nature of which has not yet been fully determined. It is more often seen in infants who suffer from inattention and uncleanliness and in those who are constitutionally enfeebled. *Treatment:* Prophylaxis is most important; careful attention to cleanliness will prevent the majority of cases.

VI. DISEASES OF UNKNOWN NATURE.

1. Omphalorrhagia. 2. Melena. 3. Miscellaneous Hemorrhages. 4. From Genitals in Female Infants. 5. Sclerema Neonatorum. 6. Buhl's Disease. 7. Winckel's Disease. 8. Mastitis. 9. Jaundice.

The preceding causes named under Sections I to V, and often the cooperation of two or more of them in a single case, are responsible for the large mortality among the newly born. The vital statistics of New York show that in about 6 per cent. of all births the children die within the first four weeks. If to this number we add the still-births, we find that in 14 per cent. of all births the

children are unable to survive. Eröss made an extensive collective investigation in 1893 and found that 10 per cent. of all children die within the first month. This author assigned "congenital debility" as the cause of death in these cases in over 50 per cent. of the material. If more of these cases came to autopsy the matter would assume a different complexion. Thus, Brothers * made 47 post-mortems on children who were either still-born or who died within a fortnight after birth, and found in most cases definite organic lesion sufficient to have caused death. Disease acquired after birth is extremely rare. (Brothers records one case of intussusception.) Intra-partum affections, on the other hand, must be very common, judging from the amount of cerebral hemorrhage and catarrhal pneumonia (provided that the latter is due to aspiration of amniotic fluid). Enough has been said to illustrate the great complexity of the subject of infantile mortality. There can be little doubt that a condition of subdevelopment, whether due to prematurity or severe maternal disease or both, furnishes a very strong predisposition to all the other conditions which menace the newly born. If we exclude from consideration that element of birth mortality which is due to actual fetal disease and malformation and to infection intra partum and post partum, we may recognize as the two leading factors the subdevelopment of the fetus on the one hand, and dystocia on the other. The condition of subdevelopment, which is practically synonymous with congenital debility, is probably responsible for more than one-half of all infantile mortality, and the actual exciting cause of death is of no special significance. The mortality from dystocia is due principally to asphyxia and cerebral hemorrhage, with a certain proportion of deaths from aspiration-pneumonia as a result of the entrance of amniotic fluid into the lungs.

Hemorrhages in General.—Somewhat different in character from the preceding is the marked tendency of the neonatal blood-vessels to rupture, insomuch that a sort of hemorrhagic diathesis appears to exist. Hemorrhages either occur independently or complicate other conditions, especially infectious conditions. Independent hemorrhages occur principally from the navel (omphalorrhagia), intestinal canal (melena), and the subcutaneous tissues. Hemorrhages into the suprarenal bodies have been noted. They are of rare occurrence and have no connection with hemophilia, since the disposition to bleed ceases with the neonatal period. The true hemorrhagic diathesis is very seldom manifested at birth. Traumatic hemorrhages are not considered in this connection, although the tendency of the newly born to bleed acts undoubtedly as a predisposing cause. Neither are the hemorrhages which characterize syphilis in the newly born and septic infection post partum included here. The disposition of the newly born to hemorrhage may be attributed to the new demands made upon the circulation by extrauterine life and the extreme fragility of the capillaries. The blood itself may undergo some peculiar change, and the fact that actual extensive hemorrhage is not of common occurrence has caused the belief in some quarters that the blood is altered by some agency, perhaps a bacterium, before it can escape in such large quantities. These hemorrhages are oftener fatal than not, but if the child can survive beyond the neonatal period it is usually safe, for then the unknown process of readjustment appears to be completed.

1. **Omphalorrhagia.**—This condition is associated with the falling of the cord about the fifth or seventh day post partum. It is insidious in character, consisting of a general sanguineous oozing from the umbilical stump. The blood shows little tendency to coagulate. When the hemorrhage is not fatal, its

* "Infantile Mortality," 1896

tendency is to spontaneous arrest within a few hours or at most days. Other hemorrhages may coexist, as may also other neonatal diseases, and in some cases omphalorrhagia is simply a collateral phenomenon of syphilis neonatorum or umbilical sepsis. The *prognosis* is almost hopeless, as the escape of blood is with difficulty checked, and, moreover, death often occurs even after the bleeding vessels have been completely ligated; suggesting that the fatal termination is due not to the escape of blood, but to the basic condition which makes the latter possible. The best *treatment* is probably compression with hare-lip pins, which will do all that can be done by hemostatic procedures. In this connection it may be mentioned that fatal omphalorrhagia may result from failure properly to ligate the cord at birth. Fortunately, omphalorrhagia occurs very rarely.

2. Melena, or Gastro-intestinal Hemorrhage.—Hemorrhage—generally capillary—from the gastro-intestinal mucous surface occurs sufficiently often in the early days of life to make it a disease of some importance. It rarely occurs after the twelfth day. *Etiology:* No satisfactory cause has yet been assigned, but the hemorrhage is due, no doubt, to changes in the blood or in the blood-vessels or in both. There is reason to believe also that a tardy or incomplete establishment of the respiratory and circulatory functions, giving rise to venous stasis, is an important factor in an etiological way. Hereditary syphilis is associated with a small percentage of cases. A microbic theory has been advanced but not accompanied with testimony sufficient to be of value. It develops at any time during the first week of life. In three cases described by Brothers, omphalorrhagia coexisted in all. *Pathology:* Many cases show no lesion at autopsy except the hemorrhage and the blanching of the involved mucous membranes. There may also be ecchymoses of the mucous membrane. Ulcers are found in the stomach and intestine in a small proportion of cases. These ulcers are multiple and small, usually superficial, but may extend to the muscular coat or even perforate the intestine. The cause of these ulcers is somewhat obscure, but some are probably of infectious origin, while others are due to thrombi in the blood-vessels of the mucous membrane. In a case in my service at the Emergency Hospital, blood was vomited and passed by rectum. The autopsy disclosed no ulcers of the stomach or intestines. Death occurred on the tenth day post partum. *Symptoms:* The presence of blood is generally the first symptom to attract attention, and blood in the stools is much more common than hemorrhage from the stomach. The general condition of the infant may be good or there may be pale skin, feeble heart action, and decided weakness. Vomited blood is usually dark in color and small in quantity, the stools are always dark, the blood and fecal matter being closely associated. Clots in the stools are not common. Occasionally death follows internal hemorrhage and the condition is discovered only at autopsy. It should be remembered that vomiting of blood may result from nursing from a fissured nipple. The *prognosis* depends upon the general condition of the infant and the frequency and amount of the hemorrhages. The mortality has been estimated as high as 50 per cent. *Treatment:* General measures, such as proper food and appropriate stimulation directed to the maintenance of the bodily strength, should be resorted to. Astringents, either by mouth or per rectum or subcutaneously, have no influence upon the bleeding. Suprarenal extract given by mouth is held to be of benefit.

3. Miscellaneous Hemorrhages.—Other localizations of this general hemorrhagic tendency are (3) the subcutaneous tissue (purpura hæmorrhagica), the extravasations occurring by preference over regions exposed to pressure; uncomplicated purpura is a benign affection, although the loss of blood may be con-

siderable. (4) The urinary passages (hematuria) and (5) the female genitals, where the escape of blood suggests precocious menstruation (see page 850).

4. Hemorrhage from the Genitals in Female Infants.—This hemorrhage may be a symptom of a number of very different conditions. In many instances the phenomenon appears to be physiological, and more than once it has foreshadowed precocious menstruation and early sexual development (St. Hilaire and others). In these quasi-menstrual cases the flow of blood begins a short time after birth and continues over a space which corresponds to a menstrual epoch. There is, however, no recurrence on the following month. In other cases it appears to have a sinister meaning, for it has been noted as a terminal phenomenon in infants dying shortly after birth, especially premature infants. Doléris * looks upon such cases as examples of a general infection of doubtful origin, and in one such instance found a pericardial effusion from which he cultivated staphylococci.

A series of autopsies would doubtless throw light upon the nature of this affection, or group of affections, but few such records exist. In one case of prematurity Eröss found blood in the uterine cavity, and an apparent condition of hemorrhagic metritis. We may at the present day distinguish between a physiological, benign type of hemorrhage, and another form which appears to stand in relation with the uterine congestion of prematurity. It is also quite probable that other conditions may produce this phenomenon. I have observed during the past ten years a number of cases of muco-sanguinolent discharge from the vagina in full-term healthy children. Mothers and nurses are often unduly alarmed at its occurrence. A mild boric-acid wash is all the treatment called for.

FIG. 1031.—SCLEREMA OF THE NEWLY BORN.—(*Browning.*†)

In addition to the hemorrhagic state and icterus which might well be placed under this head, there are a number of other affections—sclerema, Buhl's disease, Winckel's disease, mastitis, etc. It is impossible to state whether the leading element in these cases is readjustment, infection, or the persistence of some intrauterine affection.

5. Sclerema Neonatorum.—The subject of sclerema is in a hopeless state of confusion. It appears to attack the subdeveloped child only, but is much too rare to be ranked as a mere anomaly of readjustment. It is not necessarily a disease of the newly born, and hence can hardly represent the persistence of a fetal state. It cannot be brought into relationship with any infectious process. The peculiar induration first appears in localities where adipose tissue is abundant, and usually extends over most of the subcutaneous area (Fig. 1031). At the same time there is a marked lowering of temperature with failure of circulation, cyanosis and œdema often appearing. The child seldom lives over three or four days from the inception of the malady. While the general prognosis is grave, mild cases of sclerema are sometimes saved by the treatment for prematurity, including the incubator. In a certain number of cases sclerema has been noted as a mere terminal stage of exhaustion. There is a large amount of evidence that

* "Jour. de méd. de Paris," 1898, x, 349.

† "Dorsal Sclerema Neonatorum," William Browning, "Journal Cutan. and Gen.-Urin. Diseases," vol. XVIII, whole No. 219, Dec., 1900.

the affection represents only a high degree of the defective readjustment of the subdeveloped child. Unfortunately all sorts of exceptions to general rules have been noted. Ballantyne even cites a case in which no adipose layer was present.

6. Buhl's Disease. 7. Winckel's Disease.—The former has been known as "fatty degeneration of the newly born," and the latter as "epidemic hemoglobinuria of the newly born." Both conditions suggest sepsis as the cause, Winckel's disease more so than Buhl's, because the former has occurred in epidemics.

The prognosis is hopeless and the treatment entirely symptomatic in both these diseases.

8. Mastitis.—Mammary abscess belongs under "sepsis neonatorum," but the condition usually referred to as mastitis includes the condition of physiological activity so often seen in children of both sexes at birth, by virtue of which milk is for a few days secreted in minute amounts (Fig. 1032). As a result of handling, want of cleanliness, etc., pyogenic germs may gain access to these secreting glands and local sepsis may result. (See Sepsis.) The existence for two or three weeks after birth of mammary secretion is generally thought to be physiological. In any event, it is quite common. It is found as frequently in boys as in girls, the amount not often exceeding a few drops. Its chemical constituents are like those of adult milk. The condition of functional activity will generally disappear spontaneously. *Treatment:* In the majority of cases no treatment is necessary. When the glands are really inflamed, an application of ichthyol ointment, 20 per cent., lead-water and laudanum, or lead plaster may be made. In the event of pus formation immediate incision and evacuation are indicated, together with supporting and stimulating treatment.

FIG. 1032.—BILATERAL MASTITIS OF THE NEWLY BORN.—(*Author's case at the Emergency Hospital.*)

9. Jaundice.—*Icterus neonatorum* may also be included among anomalies of readjustment, although in certain cases it is a complication of sepsis, etc. The pathogeny of primary icterus is obscure, although this affection occurs so frequently that it may almost be regarded as physiological. It is often associated with uric-acid infarcts in the kidney. Primary icterus appears during the first week of life and lasts but a few days. It does not begin in the conjunctivæ, which are involved after the skin. The child loses weight during the evolution of the disease. It is almost impossible to differentiate primary icterus from the jaundice which accompanies sepsis, syphilis, malformations of the hepatic tissues, etc. Nor is it possible to distinguish between a primary icterus from anomalous action of the liver and a hypothetical hematogenous form. Jaundice of the newly born might also be of fetal origin in certain cases, and under these circumstances the pigment would come from the mother. Little or no special treatment is required, although syrup of rhubarb and calomel are often administered.

VII. GENERAL POST-PARTUM CONDITIONS.

1. Ulceration of the Hard Palate, Bednar's Disease. 2. Sublingual Cysts. 3. Vomiting. 4. Colic. 5. Diarrhea. 6. Constipation. 7. Intestinal Obstructions. 8. Pneumonia. 9. Convulsions. 10. Infantile Cachexia. 11. Sudden Death. 12. Medication of the Newly Born.

1. Ulceration of the Hard Palate, Bednar's Disease.—This is characterized by the formation upon the hard palate of two ulcers, one on each side of the median line; occasionally only one may be present. They are at first superficial. It is supposed to be caused by friction against the rubber nipple, by the habit of tongue-sucking, or by rough and careless manipulations in cleansing the child's mouth. Marasmus is a predisposing cause. The treatment is removal of the cause if possible. If marasmus or malnutrition is present, a cure may be difficult or impossible.

2. Sublingual Cysts.—What is known as the lingual duct is represented by a canal running from the foramen cæcum between the geniohyoglossi muscles to the posterior surface of the hyoid bone. In its course cysts may develop, due no doubt to an inclusion of a minute portion of epiblast or hypoblast. They are always congenital, but may not become manifest for many years, when they may become attached to the hyoid bone behind or to the lower jaw in front. The dermoid variety are lined with epithelium and contain sebaceous matter and sometimes hairs. Another variety, by far the most important, is ranula, a bluish, semi-transparent, ovoid or round swelling with thin walls located in the floor of the mouth under the fore part of the tongue. They are usually unilateral, contain glairy, mucoid material, and are painless. As a rule, they are small, but they may attain the size of a walnut and so interfere with speech and swallowing. The typical ranula is most frequently a retention cyst of the mucus-secreting glands of the floor of the mouth. The treatment is entirely surgical. Radical extirpation is practised for dermoids, while incision and cauterization are the methods most commonly employed for the cure of ranula.

3. Vomiting.—Regurgitation of food is sometimes due to the fact that the child is fed too often or in too large quantity. Thus regurgitation is of frequent occurrence. In other cases, and especially if the vomited matter contains curds, some defect in the preparation or composition of the milk is to be suspected.

4. Colic.—One of the most common symptoms which the physician is called upon to treat is colic. Too often the symptom alone is treated without proper consideration of the etiological factors in the case. *Etiology:* Some error in diet is almost always the underlying cause. In a great majority of cases it is the proteids of the milk, although any of its constituents may be at fault. Flatulence follows, due to the formation in the intestine of gas from fermentation or decomposition, and colic ensues. All severe forms of intestinal inflammation, chilling of the body-surface, or a diet containing cereals in excess are prominent causes. When colic is unaccompanied by flatulence, the pain is due to muscular spasm. It occurs in breast-fed as well as bottle-fed children, and is most common during the first three months. The pain is often severe. *Symptoms:* A child with colic presents a picture which is almost characteristic. The facial expression is one of misery, crying is violent and paroxysmal, as a rule the lower extremities are drawn up, the abdomen is tense and hard and more or less tympanitic, and in severer cases there is cold, clammy skin, with feeble pulse and possibly convulsions. The expulsion of flatus is followed by almost imme-

diate relief. The possibility of intussusception or appendicitis must be borne in mind. *Treatment:* Recalling the fact that flatulence is the predominant cause, an enema affords the greatest hope of speedy relief. From three to eight ounces of lukewarm water or a smaller quantity of sweet oil or glycerin is ordinarily effectual. Heat to the abdomen and feet is of value. Turpentine stupes to the abdomen are always grateful. When relief is afforded, it is wise to purge with fractional doses of calomel or a mild saline. When the muscular spasm is severe, opiates are indicated. A study of the patient's digestive powers and scientific modification of its food are demanded when attacks of colic show a tendency to recur. During the attack a drachm of soda-mint or a few drops of gin or brandy in a little warm water, or a few drops of compound tincture of cardamom, may afford relief.

5. Diarrhea.—Several varieties of this ordinary affection of infancy have been described, but an elaborate classification seems unnecessary, since many factors both in a causative and curative way are common to the various forms. Three or four movements a day, if normal in consistency and in color, need excite no apprehension. If the passages are greenish and contain undigested particles, attention should be directed to the feeding. *Treatment:* To remove all irritant matter from the intestine is the first feature which requires attention. A purge with castor oil, calomel, or a saline should be given. At times a high injection of a quantity of decinormal salt solution, with or without some mild astringent,—witch-hazel, for example,—is an effective adjunct to catharsis. When a thorough evacuation has been accomplished, some preparation of opium may be given to lessen peristaltic activity. During the attack the diet should be very limited; in some cases nothing but very moderate quantities of water, plain or in combination with egg-albumen or barley, should be administered in the first twenty-four or forty-eight hours. When the condition of the patient warrants, the diet should be gradually increased. Plenty of pure water must be given. If diarrhea continues and bids fair to be exhausting, two to four drops of paregoric, with four drops of aromatic sulphuric acid or gr. iij to v bismuth subnitrate, may be tried. The paregoric should not be repeated, however, until the effects of the first dose have entirely disappeared. The bismuth may be repeated as indicated.

FIG. 1033.—GLASS RECTAL SYRINGE.

FIG. 1034.—RUBBER RECTAL SYRINGE.

6. Constipation.—The term constipation in young children signifies any delay beyond the normal period in the passage of fecal matter. *Etiology:* Anatomically the formation and disposition of the colon predispose to constipation. Its relative length is greater than in the adult, its walls are relatively weaker, and their physiological activity is not fully developed. Congenital abnormalities, such as narrowing of the lumen of the gut, are rare causes in infancy. Among the exciting causes, which include deficient glandular secretion, excessive perspira-

tion, inflammatory conditions, and frequent purgations, we find that improper feeding and lack of general muscular tone furnish the majority of cases. The mother's milk may be deficient in fats, while artificially prepared foods are not only lacking in the proper amount of fat, but are also often too easily digested, leaving but little residue to form the basis of a proper stool. Too great a quantity of proteids or an insufficient fluid supply will also lead to constipation. Rickets is a potent cause. *Symptoms:* The number and character of the stools in each twenty-four hours give the most reliable information concerning the alimentary processes. In the newly born one or even two or three stools each day do not preclude the existence of constipation when the movements are drier and firmer and more lumpy than normal and are expelled by straining. When daily stools do not occur without medicinal or mechanical assistance, other symptoms may arise, as flatulence, distention of the abdomen, colicky pains, restlessness, disturbed sleep, and even high fever, convulsions, and much prostration. Hernia and prolapsus ani may be resultant phenomena. *Treatment:* The attention of the mother or nurse should be directed to the formation of a regular habit; even very young infants seem to appreciate the motive of being placed in the chair at certain daily intervals. The method of feeding should be investigated and the cause removed if possible. Constipation may be due to the presence of too little fat or too much proteid matter in the food. The introduction of a suppository of pure castile soap is a simple and usually effective way of causing a movement, since in most cases the trouble is due to the presence of a rather hard fecal mass in the rectum. If the continued use of the soap suppository causes irritation, the domestic resource, a cone of oiled paper, may be used. The prolonged use of glycerin suppositories may cause considerable irritation and even inflammation. The habit of regular movement may be cultivated by giving the child a suppository at a certain hour each day. If it becomes necessary to give an enema, not more than half an ounce of pure castile soap and water should be given, since the rectum in young children is relatively small. When water is not effective, the injection of a little sweet oil may be promptly successful. When suppositories or enemata are ineffectual, a drachm or two of sweet oil by the mouth is sometimes useful. Much benefit may often be derived from the administration of fifteen drops of cod-liver oil three times a day. An effort should be made to regulate the bowels by attention to food and by the use of suppositories, and by dispensing as far as possible with the use of laxative medicines. Castor oil should not be given in the habitual constipation of infants. If medicine becomes necessary, a few drops of the fluid extract of cascara sagrada may be given, or a little milk of magnesia. Massage of the abdomen is often useful.

7. Intestinal Obstruction.—The majority of these cases occur during the first year of life, and the prompt recognition and treatment of the condition are most important. *Etiology:* In the newly born, malformation—such as imperforate anus, occlusion of the rectum, or maldevelopment of any portion of the intestinal tract, more often of the duodenum—plays an important part. During the first six months of life intussusception is responsible for one-half of the cases. *Treatment:* The proper treatment of intussusception consists in efforts to reduce the displacement by pressure from below. Two methods, inflation and injection, are employed. Inflation should be practised under an anesthetic, the amount of air introduced being regulated by the amount of tension of the abdominal walls. Injections of lukewarm water are given, the buttocks being elevated to aid the entrance of the fluid into the bowel. Reduction is generally followed by gurgling sounds and the expulsion of flatus, with quick relief from all distressing symp-

toms. Laparotomy must be resorted to at times. For the congenital causes of intestinal obstruction surgical treatment is necessary.

8. Pneumonia.—(See Acute Infectious Diseases, page 808.)

9. Convulsions.—The term convulsions is here employed to designate the bodily conditions characterized by acute seizures, clonic, rhythmic, sometimes violent, generally involving one set of muscles, or the entire muscular system, with unconsciousness as a usual accompaniment. They occur as a symptom in a great variety of diseases, but here only those occurring in infancy will be considered. *Etiology:* Infancy itself is the great *predisposing* cause. The infant cerebrospinal system is easily impaired and deranged, and readily loses its equilibrium, especially during the period of its most active development. Some children inherit susceptible nervous temperaments. In older children rickets is the most prominent predisposing cause. Of the *exciting* causes, some irritant in the alimentary canal, due to transitory changes in the mother's milk, or to improper food, is the most frequent and leads to gastric or intestinal indigestion. The irritant may produce convulsions reflexly, but authorities are now practically agreed upon the adoption of the toxic theory as the proper explanation. Atelectasis, meningitis, and meningeal and cerebral hemorrhage are direct causes. Dentition is an extremely rare cause. Retention of urine and phimosis are sometimes directly responsible. *Symptoms:* General convulsions do not differ materially from ordinary epileptic seizures so far as the infant's appearance is concerned. In some cases prodromal signs of restlessness and irritability may give warning, but most often the attack comes on suddenly. The face is pale or cyanosed, the head is thrown back, the eyes roll or are staring, the hands are clenched with thumbs adducted to the palms, then twitchings of the eyelids or the face or of one extremity are soon followed by clonic movements of the entire body. Foaming at the mouth is common, the heart is rapid and weak, the pulse irregular, respiration embarrassed, urine and feces may be voided involuntarily, and the entire body surface is covered with clammy perspiration. Gradually the convulsions cease and the child passes into a sleep or stupor, to be followed in most cases by one or more convulsions. Unilateral convulsions make one suspicious of a cranial lesion, while those occurring with fever of 103° to 106° F. are suggestive of the onset of acute infectious disease. *Treatment:* This is first directed to the controlling of the spasms. Baths at a temperature of 105° to 110° F., given for from five to fifteen minutes, are the most effective means at our command. In infants under four months of age the skin is tender and plain water is sufficient, but in older infants mustard—a handful to four gallons of water—will enhance the effectiveness of the baths. In severe cases the temperature of the bath should be increased to 112° or 115° F., and the child immersed for at least ten minutes. Friction of the entire body, but particularly to the extremities, should be performed. After the bath the infant should be wrapped in a warm blanket and placed on its right side to relieve the overburdened right heart. An ice-bag to the head and hot bottles to the feet are always useful. Chloroform by inhalation is necessary at times in older children, and chloral hydrate and sodium or potassium bromide per rectum in proper doses are useful and powerful sedatives. As soon as the convulsion is controlled an enema should be given to insure a thorough action of the bowels. A purge is always indicated, and castor oil is the best of that class. Up to the age of five months the administration of one-half teaspoonful will ordinarily be followed by good results. If there is much prostration, whisky in ten to thirty minim doses should be given every two or three hours.

10. Infantile Cachexia.—(See Inanition, page 840.)

11. Sudden Death of the Newly Born.—In infants who present no visible external changes sudden death is not an infrequent occurrence. The excitability of the nervous centers in the young and their violent response to conditions incapable of serious results in older persons tend to make this subject one of extreme interest, especially in a medico-legal way. It is generally due to one of the following causes: *Asphyxia* occurs from over-lying in bed, from particles of food lodged in the larynx, or from an enlarged thyroid gland pressing upon the trachea or pneumogastric nerve. Of the infants who are born in a state of asphyxia and respond to methods of resuscitation, about 4 per cent. die within three days after birth and autopsy reveals a condition of atelectasis. *Convulsive disorders:* Seven per cent. of sudden deaths are referred to this cause. In infants, in nine cases out of ten, convulsions are due to some irritant in the alimentary canal; in older children rachitis is the great underlying cause. Cranial hemorrhage is also a cause of convulsions, but children rarely die suddenly from it. *Infantile cachexia:* This is one of the common causes, and heart failure is the most probable cause of death, since real lesions are rarely found at post-mortem examination. *Internal hemorrhage:* Hemorrhage into the brain, lungs, pleura, stomach, intestines, or any of the abdominal organs gives symptoms of sudden collapse quickly followed by death. This occurs very early in life, the infant seemingly being affected by the sudden change from intrauterine to extrauterine existence. *Pulmonary congestion:* This may complicate any sudden and great rise of temperature and cause death in a few hours. In the acute infectious diseases, particularly bronchopneumonia, a certain number of infants are overwhelmed by the intensity of the intoxication. As other causes of sudden death may be mentioned congenital malformations of the principal bodily organs, such as hernia, hydrocephalus, patent foramen ovale or ductus arteriosus, defects in the ventricular septum, diaphragmatic hernia, narrowing or occlusion of the stomach or intestines, imperforate anus, and abnormalities of the kidney and ureter.

12. Medication of the Newly Born.—The infant is often treated through the mother, but the amount of a drug which reaches the former through the milk is now believed to be too insignificant to produce therapeutic results. It therefore becomes necessary at times to administer medicines directly to the newly born. *Stimulants:* These have a very wide field, being indicated in the numerous severe septic affections as well as in prematurity and general debility. The dose is 1 to 3 drops of whisky hourly, increased in septic cases. *Sedatives:* In case of colic or other pain which resists attempts to regulate the diet, etc., a mild opiate may be given (paregoric, 1 to 5 ♏). The bromides and chloral are useful per rectum. *Stomachics:* For indigestion, flatulence, colic, etc., carminatives are indicated, with small doses of calomel ($\frac{1}{10}$ grain every three hours). Antacids are also useful (soda, magnesia), as also is pepsin. *Laxatives:* When mild remedies like sugar will not suffice, calomel, castor oil, and cascara sagrada are most effective. *Diuretics:* Sweet spirits of niter is the remedy usually chosen to produce diuresis in the newly born. *Local remedies:* The toxic antiseptics should be used well diluted, if at all (*e. g.*, corrosive sublimate 1 : 10,000). Boric acid is preferable, as a rule, to the poisonous drugs. Counterirritation is practised chiefly for colic and vomiting. in the form of a spice poultice over the abdomen.

PART TEN.

Obstetric Surgery.

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(A) INTRODUCTION.

The subject of obstetric surgery falls naturally into three divisions: The *first* embraces operations preparatory to delivery, such as the premature induction of labor; removal of the barrier of the cervix; correction of faulty presentations, attitudes, and positions; increasing the size of the pelvis by symphyseotomy or diminishing the size of the fetus by craniotomy or cutting operations on the trunk. The *second* division includes operations for delivery, such as expression, manual and forceps extraction, Cæsarean section, and various methods of placental delivery. In the *third* division fall the various operations for the correction or repair of injuries produced during labor.

In considering the subject of obstetric surgery, my aim will be to give briefly and concisely an account of the best method of dealing with the various forms of dystocia, and an effort will be made to give in condensed form the gist of modern scientific teaching and of my own experience in each case. The discussion of unconfirmed theories, disputed points, and measures of doubtful expediency will be avoided as unsuited to a work of this character.

Labor is a physiological process, and in normal cases the less interference the better. No consideration of time or convenience, or even the entreaties of the patient or her friends, should be used as an excuse for interference unless such interference is distinctly indicated in the interest of mother or child. Various abnormal conditions and causes, however, into which it is not now necessary to enter, may render operative interference not only justifiable but imperative.

Primum non nocere is a principle not always easy to impress upon the undergraduate student. The student in his two or four weeks' course in practical obstetrics may possibly witness many obstetric operations and naturally draw the conclusion that interference in cases of confinement is of common occurrence, when we desire to impress upon the student's mind quite another picture. With a false impression the young physician enters upon his practice, and one unnecessary operation leads often enough to a long train of misfortunes. Unfortunately we see many examples of the foregoing. A primipara, for instance, has been in labor for twelve hours; the membranes have ruptured several hours previously; the head rests upon a rigid pelvic floor; which latter delays the second stage; the fetal heart is good; the mother is in excellent condition, and as yet there is no danger of damage to the soft parts, as the head has only just reached the pelvic outlet; there is, therefore, no indication for interference. A hurried low-forceps operation is performed; a third degree laceration of the pelvic floor results; a hurried operation for repair is done, which in the absence of proper assistance and ligatures gives a bad result. What follows? A subsequent operation must be performed by an expert, and in the mean time, and possibly after the second operation, should it too fail, the patient is doomed to rectal incontinence and becomes an exile from society, and all because in the first instance in the absence of a positive indication, a "harmless low-forceps operation" was

performed. Still another clinical picture presents itself. A pelvic presentation occurs in a multipara. One foot prolapses and appears at the vulva. Mother and fetus are in perfect condition. There is positively no indication for interference, but the temptation is too great. In order to facilitate delivery, the attending physician seizes and makes traction on the prolapsed leg. What results? The head, as well as one or both arms, becomes extended. Delay in the delivery of the extended arms and head causes death of the fetus. The difficult extraction results in deep laceration of the cervix extending into the folds of the broad ligament. Severe hemorrhage follows. A hasty tamponade of uterus and vagina, not under aseptic precautions, results subsequently in severe endometritis and parametritis. What is the termination of such a case? Death of the child, and the mother left with crippled pelvic organs, perhaps for life, all from an attempt to facilitate the progress of labor by traction upon a prolapsed leg.

The student cannot have too often repeated to him the statement that obstetric operations of any kind should be undertaken only in the presence of a positive indication; that even what are apparently innocent operative procedures in obstetrics may terminate in tragedies. The more impressed the student is with the full meaning of the term *primum non nocere* during his residence in the medical school and maternity, the more conservative and the better accoucheur will he become in his private practice, the better the fate of the mother and child entrusted to him, and the better his professional reputation.

I. PREPARATIONS FOR OPERATION.

Patient.—Many obstetric operations may be performed with the patient placed across the bed in the lithotomy position, the buttocks being drawn to the edge. The flexed thighs are either held or, better, confined with a sheet or canvas crutch. Rubber sheeting or a Kelly pad and a pail are used for drainage (Fig. 1048). It is far better, however, in private practice, to improvise an operating table by pressing into use the kitchen, dining-room, or other table. This should be covered with an old blanket and a clean, freshly laundered bed-sheet, and a Kelly pad or a rubber sheet placed at the foot to drain into a pail or foot-tub. The patient should be anesthetized in bed and afterward placed upon the table in the lithotomy position, with thighs held in flexed position by a twisted sheet under the shoulders or a Clover crutch (Fig. 1079). The rectum must have been emptied by an enema. The external genitals should be scrubbed with soap, brush, and warm water. For all intrauterine or cutting operations the pubes and vulva should be shaved. A catheter should be passed and a final scrubbing with a sublimate solution (1 : 2000) or 1 per cent. lysol performed. The immediate field of operation should be surrounded with sterile towels. The vagina should be carefully washed out, before all intrauterine operations, with a 1 per cent. lysol or creolin solution. This should be done with the fingers, a cotton swab, or a jeweler's brush, never with a stiff brush, which would injure the vaginal mucous membranes.

Instruments and Dressings.—The antiseptic agents used in obstetrical practice are the same as those used in general surgery. Heat is the most useful and easily applied means for making dressings and instruments sterile. Dry heat is the least convenient form to use, since it takes longer to accomplish its purpose than does moist heat and is slow in penetrating to the interior of a bundle of dressings.

Moist heat may be used as steam at ordinary or increased pressure, or in the form of boiling water. Superheated steam does not penetrate much better than dry heat. Many hospitals use an instrument which subjects its contents to steam at about 250° F. (121° C.) at 15 pounds pressure, and this is found very efficacious for dressings and other materials. Boiling in plain water, or, better, in water to which about 1 per cent. of sodium carbonate or bicarbonate has been added, is an exceedingly convenient method of sterilizing instruments or anything which will stand the treatment. The addition of the soda prevents rusting and shortens the time necessary for boiling. Five minutes of active ebullition is enough. The soda should be chemically pure; otherwise substances might be present which would injure the instruments. In private practice obstetric instruments should be contained in canvas cases (page 468) or pinned in towels before boiling. They are then brought to the operating table on a dish without removing the towel and taken directly from the towel for use in the given operation. Trays and antiseptic solutions for instruments are thus dispensed with.

Operator.—(See Asepsis in Obstetrics, page 148.)

II. DECINORMAL SALINE SOLUTION INJECTIONS.

INFUSION, ENTEROCLYSIS, HYPODERMOCLYSIS.

On account of the great importance of this resource in obstetrics and the number of conditions for which it may be indicated—including eclampsia, hemorrhage, and sepsis—I have thought it advisable to devote a special section to the general principles and technique of the various methods of exhibiting the saline solution.

Preparation of the Solution.—The decinormal saline solution consists, roughly speaking, of a drachm of salt (sodium chloride) to a pint of water, but this simple formula has been modified in various ways. Water alone, provided that it is not distilled, may replace the salt solution in emergencies; and any proportion of salt will answer which does not exceed three times the proportion normally contained in the blood. As a matter of fact, the solutions in use vary from $\frac{6}{10}$ per cent. to $\frac{8}{10}$ per cent. To prepare a solution with accuracy, forty-six grains are added to a pint of water, but in emergencies a small teaspoonful, not heaped up, will suffice. After the solution has been prepared it should be boiled and filtered. While the saline solution is supposed to be freshly prepared at the time of use, it is necessary in hospital practice to have it constantly on hand, and the custom which generally prevails is to prepare a concentrated solution which can be diluted as required. The solution must be exhibited at a certain temperature. While 100° F. is the conventional temperature, some obstetricians prefer 105° to 110° F. as representing a gain in stimulating properties.

Rectal Infusion.—From four ounces to a pint and a half of the decinormal salt solution, at a temperature of 110° to 120° F., should be kept in the bowel continuously. Any of the usual rectal tubes may be used, but a soft-rubber catheter attached to the tube of a fountain syringe usually causes the least irritation. The patient may be placed in the dorsal or lateral position, and it is convenient to have the buttocks project a little over the edge of the bed. I have found that the left lateral posture with elevation of the hips favors retention of the solution, and is least objectionable to the patient (Fig. 1051)

Indications: As a preventive or curative measure in cases of shock, especially of shock from hemorrhage.

Intra-arterial Infusion.—The radial artery is the vessel usually chosen for infusion, on account of its accessibility. The skin is scratched over the artery as a guide, the limb is elevated, and a tourniquet is applied to the upper arm. The incision is 1 or 2 inches (2.5 or 5 cm.) long and crosses the artery obliquely. The vessel is carefully isolated, divided, and ligated at the central end. A cannula is then inserted into the peripheral end and tied in while infusion is proceeding. The tourniquet is then loosened, and after the infusion is completed the cannula is withdrawn and the peripheral end of the vessel is also ligated. This form of intervention is too radical and complicated for routine use.

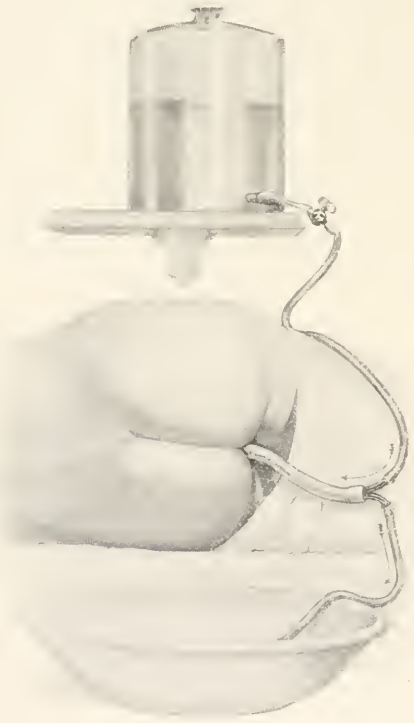


FIG. 1035.—COLON IRRIGATION WITH A DOUBLE CATHETER.

Intravenous Infusion. — *Indications.*—The indications for intravenous infusion are similar to those of other methods of exhibiting the salt solution. Generally speaking, it is the typical method, the others having a more limited field. In sepsis and eclampsia or toxemia in general, it is sometimes the custom to conjoin phlebotomy with infusion. The incision made for the cannula will suffice for the escape of the blood, which should average about a pint. In certain cases venesection is carried out in one arm and infusion in the other, the operations being synchronously performed. The reaction against the teaching of the past, that entrance of air into a vein is a fatal accident, is believed to be unwise. Fatalities certainly have occurred, and it is well to take all precautions. Experiments on animals show that the rational treatment of air in the veins is the persistence in the process of infusion at 110° F., with artificial respiration.

Technique.—The solution should be contained in a glass irrigating jar having a capacity of five pints or more. The flow should never exceed the rate of a pint in five minutes. The jar should be provided with a bath thermometer, and an apparatus for raising and lowering it to any desired height. While infusion is in progress it is well to wrap the irrigating jar in a large, hot, sterile towel to assist in maintaining the requisite degree of heat. This outfit is required because intravenous infusion is almost a routine procedure at the present day. In emergencies a fountain syringe may be used, the infusion being made as hot as the hand will bear. The tubing of the irrigating jar is fitted with a transfusion cannula (Fig. 1038) or the glass tube of a medicine-dropper may be used as a cannula. The operation is preceded by the application of a tourniquet to distend the veins. The most conspicuous vein should then be chosen, and this, as a rule, is the median basilic. A cuta-

neous incision is made of sufficient length to expose about half an inch (1.25 cm.) of the vein, which is then isolated and raised from the wound (Fig. 1036). The vessel is then tied with fine catgut as low down as possible and a second ligature is placed high up, ready to be knotted when desired. Half of the circumference of the vein is now divided with scissors, the incision being just above the knotted ligature. The cannula with its stream of running water is now inserted as far as possible into the incision, with point directed toward the heart, and the second ligature knotted to retain the instrument in place. The knot should be a bow, in order that the ligature shall be only temporary. After the cannula is removed the same ligature may be used for the purpose of tying the central end of the exposed vein. After application of the temporary ligatures the tourniquet should be removed. Kemp emphasizes the fact that a very common mistake of the beginner is neglecting to remove the tourniquet before proceeding with the infusion; under these circumstances the increase in intravenous pressure will burst the vein sooner or later.

FIG. 1036.—INFUSION OF SALINE SOLUTION INTO A VEIN OF THE ARM.

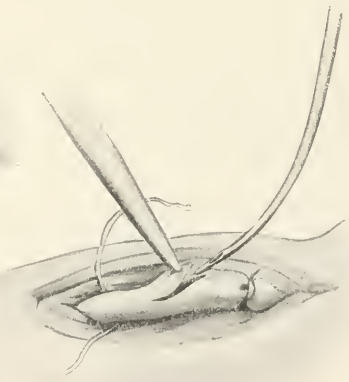


FIG. 1037.—SAME AS FIG. 1036, BUT ENLARGED.

FIG. 1038.—CANNULA FOR INTRAVENOUS INFUSION.

Enteroclysis.—No special apparatus is required, as the single- or double-current irrigation tubes will suffice. Assuming that the solution should have a temperature in the intestine of at least 100° F., it should be exhibited one or two degrees higher to allow for slight cooling. The dorsal position appears to be the best, the hips being slightly elevated. It is well to let the solution escape while the tube is being inserted. A number of double-current rectal tubes have been devised for the purpose of continuous exhibition of liquids. There are other advantages connected with the double system, for the temperature as well as the quantity is under control. Continuous irrigation may easily be maintained for an hour or more, and the patient may remain entirely passive. A double-

current irrigator may be improvised as follows, if the operator has no special delivery tube. Two catheters of different caliber should be so fastened side by side that the tip of the smaller instrument projects an inch or two beyond the larger, and above it, so that the inflow may be on the higher level. These catheters should be made to pass through a perineal pad or substitute before insertion into the bowel. The escape tube is the larger, for with mucus, etc., it must carry away more than enters through its smaller fellow. Dr. R. C. Kemp, whose valuable monograph * I have freely consulted in the preparation of this section, has devised a double-current irrigator which is the result of much study and experience in this department of therapeutics † (Fig. 1035).

Indications.—In shock, whether post-operative or following hemorrhage, irrigation is so managed that the patient has a pint or a quart of infusion in the bowel at any given moment. Continuous irrigation, maintained for a considerable period, is especially indicated in the toxemia of pregnancy. (Page 299.) The hot solution (110° F. to 120° F.) is advocated in these cases. While enteroclysis has but few indications in obstetrical practice, by reason of the greater excellence of hypodermoclysis and infusion, it can nevertheless be employed to a considerable extent by practitioners who are unfamiliar with the other methods, or who lack the necessary apparatus for their performance.

FIG. 1039.—SUBCUTANEOUS INFUSION OF SALINE SOLUTION INTO BOTH BREASTS (HYPODERMOCLYSIS).

Hypodermoclysis.—This method of exhibiting the salt solution consists in its injection into the subcutaneous cellular tissue. *Indications:* Since hypodermoclysis increases the quantity of fluid in the vessels, thereby making good any deficit, as well as acting as a circulatory stimulant; and since it promotes the action of the emunctories, and both dilutes and expels toxic substances, it is naturally indicated in obstetrical practice in the pregnancy kidney and eclampsia, in post-partum hemorrhage, shock, and sepsis. Enteroclysis is a valuable adjuvant to hypodermoclysis, either during or after the performance of the latter. *Dangers:* The little operation required for this purpose is simple, but by no means entirely free from danger. Sloughing has followed hypodermoclysis beneath the female breast. The necessary precautions in injecting the saline solution beneath the skin comprise avoidance of overdistending the tissues by too much liquid or too great rapidity of flow, and manipulation of the apparatus in such a manner that no air is able to enter the tissues. *Site of Injection:* The iliolumbar site (*i. e.*, the space between the crest of the ilium and the lower border of the ribs) possesses natural advantages as the site of injection. The patient may thereby retain the dorsal position and have the free use of all her limbs. Submammary injections are also useful. In shock or hemorrhage it may be necessary to give injections in more than one locality. *Technique:* As a general rule, from 4 to 8 ounces constitute a

* "Enteroclysis, Hypodermoclysis, and Infusion."

† *Op. cit.*, and "Medical Record," July 24, 1897.

single injection in hypodermoclysis. The solution to employ is the ordinary decinormal formula. The technique of hypodermoclysis is as follows: The apparatus required is simple, consisting of a fountain syringe and an aspirating or hypodermic needle (Fig. 1039). If an ordinary hypodermic needle is used, the bag of the fountain syringe must be raised to the height of from 4 to 6 feet, because of the increased resistance of the fine lumen; and, generally speaking, the larger the needle, the lower the pressure required. Much time is wasted if a hypodermic needle is used. The average height to hang the bag, if a medium-sized aspirator is used, is two or three feet, depending on the rapidity of the flow. The fountain syringe and its tube, together with the needle used, should all be sterilized by boiling, and the bag should contain more water than is injected lest air enter the in-flowing stream. The fluid should flow freely from the needle as the puncture is made. The same precautions are to be used as in any hypodermic injection in regard to the introduction of the needle. If more solution is needed,—and as much as a pint may be employed with benefit in some cases of hemorrhage,—it should be injected in divided quantites into different localities (Fig. 1039). The temperature of the solution should beiabout 105° F. if a large needle is used, but at least five degrees higher if the s mall hypodermic needle is employed, since fully that amount of heat will be lost with a fine needle. Local anesthesia may be applied before the puncture, if desired.

III. ANESTHESIA IN OBSTETRICS.

1. During Labor.—Choice between Chloroform and Ether.—The relative advantages of chloroform and ether are very different when it is desired to induce analgesia after the beginning of labor. Here two factors contribute to increase the safety of chloroform. They are: First, the stimulating effect of the labor pains upon cardiac innervation; second, the "physiological anesthesia" attendant upon cerebral congestion induced by the bearing-down efforts. The first factor helps to prevent chloroform syncope, and the second to diminish the amount of chloroform required. It is nevertheless true that the safety of chloroform in labor is relative, not absolute, and that fatal cases have been recorded. Its prolonged administration—*e. g.*, when commenced early in labor—is not only injurious to the mother, but, as recent observations have shown, is likely to be fatal to the child. Ether is used by a few obstetricians as an analgesic during labor. It has been found that most of the objections to its use have little force, or have been due to its improper administration, and for six years past I have used it almost to the exclusion of chloroform in both normal labor and obstetric surgery.

Indications.—The most common indication for anesthesia is unusual severity of the pains. If the labor is long and the pains are abnormally severe, its use is justifiable on the ground of humanity and to diminish the shock attendant upon severe and prolonged suffering. The administration of the anesthetic, however, should be delayed as long as practicable and confined principally to the second stage. An anesthetic is frequently useful in aiding the progress of labor, especially in the case of nervous and sensitive women who are badly affected by the pains, and in cases in which the contractions, while very painful, have but little power and in which the uterus does not relax between the pains. In cases like the above, in which the reflex influence of the pains delays the progress of labor, superficial anesthesia during the pains is frequently very

useful. Anesthesia in the second stage will often serve to induce timid and nervous patients to assist the progress of labor by voluntary efforts. Anesthesia to the surgical degree while the head is passing the vaginal outlet is often of the greatest value in preventing perineal laceration, especially in primiparæ. In ordinary cases the anesthesia is to be used only during the pains, and in quantities only sufficient to dull the pains, complete anesthesia being carefully avoided. Anesthesia after delivery should be dispensed with unless imperatively indicated. *Contraindications:* The contraindications to the use of anesthesia during labor are the same as in general surgery, with the important modification, however, that the excitement, suffering, and muscular exertion which accompany labor without anesthesia may be more dangerous in certain morbid conditions—*e. g.*, cardiac disease—than the anesthesia itself. *Advantages:* Anesthesia during labor diminishes pain; in certain cases aids in the progress of labor; by relaxing the tissues aids dilatation of the cervix; and aids materially in the preservation of the perineum. *Disadvantages:* In some cases it diminishes or suspends uterine contractions; produces unpleasant or dangerous after-effects; and predisposes to post-partum hemorrhages; and if excessively used, to subinvolution and consequent sepsis.

Fig. 1040.—The Administration of Chloroform with an Esmarch Inhaler.

Administration of Chloroform. — The patient being in the recumbent position and the usual precautions of examining heart, lungs, and urine, removing false teeth, and anointing the skin about the mouth and nose having been observed, at the beginning of a pain a few drops of chloroform are dropped upon a towel or napkin, held a few inches from the nose so as to allow a sufficient admixture of air. This is the "drop" method. An Esmarch inhaler is convenient (Fig. 1040). Valuable rules for the administration of chloroform are: (1) Use as little chloroform as possible. (2) Use napkin, towel, or Esmarch inhaler and the "drop method." (3) Have the chloroform vapor well diluted with air, especially at the beginning of anesthesia. (4) At first use only during uterine contractions. (5) When an operation is necessary, disease of the heart, lungs, or kidneys, or exhaustion attendant upon the third stage, are not contraindications to anesthesia. Nevertheless the least dangerous anesthetic or combination, such as nitrous oxide and ether or ether and oxygen, should be employed, and extreme care exercised in their administration. Valuable danger-signals in chloroform narcosis are: (1) Sudden paleness or lividity of the face. (2) Shallow, sighing respiration. (3) Rapid, irregular, intermittent, or failing pulse. (4) Sudden dilatation of the pupils.

Administration of Ether.—If ether is used, the quantity may be somewhat larger, and an improvised cone, made from a newspaper or a folded towel, may be employed. Both in normal labor and obstetric surgery I am accustomed to use an Allis inhaler (Fig. 1041). I begin its use in the latter half of the second stage, often earlier, as early as the end of the first stage; in the last instance, however, only during the acme of the pains, and to a very moderate degree of anesthesia.

2. For Obstetric Operations.—Choice Between Chloroform and Ether.—The choice of an anesthetic for obstetrical operations will vary with the operator. In the case of an operation performed before the beginning of labor, we are influenced in our choice by the same conditions which would influence us in the performance of any surgical operation. The only exception to the rule is in the case of puerperal eclampsia, in which most authorities advise the use of chloroform in preference to ether. In Europe and in the southern and western portions of this country chloroform is usually preferred, although ether is undoubtedly gaining ground, while in the northern and eastern sections of this country ether is used in the great majority of cases. In the face of modern statistics there can be little doubt that under ordinary circumstances, and especially in the hands of any but an expert anesthetist of large experience, ether is the safer, and therefore the preferable anesthetic. Chloroform is undoubtedly the more convenient, but, as I have remarked in another connection, no question of convenience should be allowed to interfere with the safety of the patient. The ordinary alleged contraindications to the use of ether, such, *e. g.*, as pulmonary and nephritic complications, etc., are discussed in text-books upon surgery, to which the student is referred.

Fig. 1041.—Self-administration of Ether with an Allis Inhaler for Dulling the Intensity of the Pains.

3. Anesthesia as an Aid in Diagnosis.—In doubtful cases it is sometimes necessary to insert the hand into the uterus in order to make a positive diagnosis. In these cases one should carry the anesthesia to the surgical degree, since complete relaxation greatly facilitates the examination. The anesthesia, however, should be discontinued as soon as practicable.

Other Anesthetics.—*Chloral* is a valuable agent for inducing analgesia during labor. Under its influence the severity of the pains is diminished and between the pains the patient is drowsy and comfortable. It also helps materially in aiding dilatation of the cervix. It is especially useful in the case of nervous and sensitive women and in cases in which the severity of the pain is out of proportion to the progress of the labor. Chloral may be given in fifteen-grain doses repeated at intervals of twenty minutes. Not more than three doses should be given, and one or two are usually sufficient. *Morphin*, either by the mouth or hypodermically, is sometimes useful, especially when anemia or debility renders other agents inadvisable. (See Prolonged Labor, page 572.) *Antipyrin* in large doses has been successfully employed, but in the presence of safer methods its use does not seem advisable. The topical application of a solution of cocain to the cervix produces a limited degree of anesthesia during the stage of dilatation. The objections to its use are the possibility

of constitutional symptoms, and the danger of sepsis from intravaginal manipulations.

Spinal Anesthesia.—Until further reliable confirmation of the safety and value of lumbar anesthesia is received, it seems advisable for obstetricians in general to refrain from exposing their patients to its dangers.

Conclusions.—(1) For operations requiring anesthesia to the surgical degree, ether, unless contraindicated, is to be preferred, except in cases of eclampsia. (2) In surgical anesthesia during labor in which the operation is begun under chloroform, and especially in the case of anemic and exhausted patients, ether may advantageously be substituted for the remainder of the operation. (3) For dulling the pains of labor, chloroform carefully used, and carried only to the extent of primary anesthesia, is both convenient and relatively safe; but when this intermittent anesthesia is long continued, it is likely to affect the fetus injuriously and is dangerous to the mother, and ether is to be preferred. (4) Chloral and morphin, especially the former, are, when indicated, of great value. (5) The production of local anesthesia by topical applications to the cervix is not to be advised.

IV. POSTURE IN OBSTETRICS.

A study of the posture assumed during labor by the women of barbarous and semi-civilized races teaches us nothing of practical importance. Custom rather than instinct appears to dictate the choice of these obstetric attitudes. The women of contiguous tribes may show notable differences in this respect. Those who are interested in the subject of labor among primitive people may consult the special works of Engelmann and Witkowsky. Instinct may indicate the best position for the woman at a given moment, but we have no right to assume hastily that this position would be the best for other women or for the sex as a whole. Some of the poses adopted by women under these circumstances appear to be distinctly contraindicated at the time. Does a woman ever instinctively assume the Walcher position when the head is trying to enter the brim? However, the postures assumed by the vast majority of women in the different stages of labor are such as harmonize with the mechanism of labor; thus, when the fetal head is high the patient prefers to stand erect, sometimes even leaning a little backward. After the head has passed the brim she leans forward, or perhaps kneels to assume the sitting position; while if lying down, she draws up her knees and perhaps raises the head and shoulders. A rational study of the relation of posture to labor is of the greatest importance and leads to most practical results.

There are but two classes of posture which have a special bearing upon midwifery. *First*, those which alter the shape of the pelvis; *second*, those in which the pelvis is elevated so that it becomes the highest portion of the trunk. A knowledge of the former enables the obstetrician to facilitate delivery through the resulting diminution of the osseous resistance; while familiarity with the latter enables him to retard labor and replace small prolapsed parts, perform version, etc. These classes will be considered in detail.

1. POSTURES WHICH ALTER THE SHAPE OF THE PELVIS.

Owing to the mobility of the pelvic articulations, certain changes in the position of the patient are accompanied by corresponding changes in the dimen-

sions of the pelvis. Owing to serous infiltration and consequent softening of the pubic ligaments, the separation of the bones at the pubic symphysis is normally exaggerated during pregnancy, and thus the circumference of the pelvic inlet somewhat increased. It is not generally recognized, however, that the limited but appreciable movements of which the sacro-iliac joints are capable are an important factor in the production of changes in the pelvic dimensions. In the erect position or in the horizontal position with extended thighs there is a slight backward movement of the sacrum which tends to increase the antero-posterior diameter of the inlet. On the contrary, if the thighs are strongly

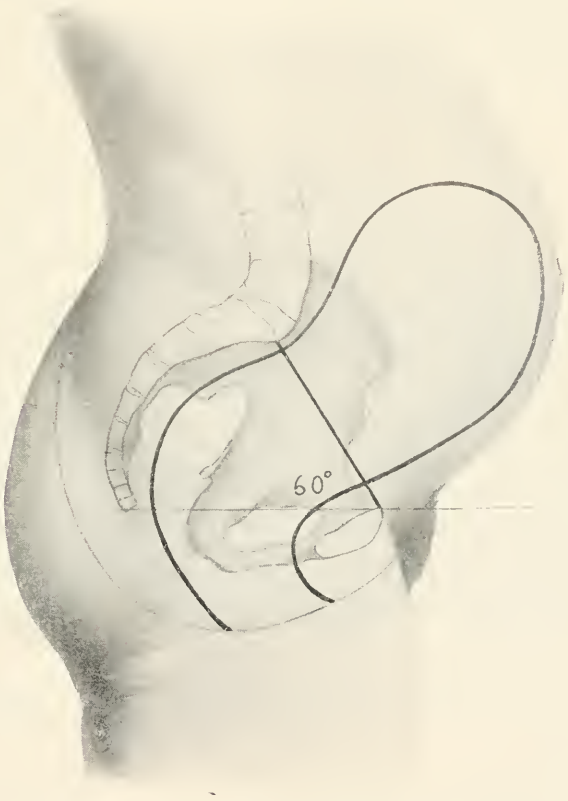


FIG. 1042.—ERECT POSTURE, SHOWING THE PARTURIENT TRACT AND DEGREE OF PELVIC INCLINATION.

flexed and the body is bent forward the upper end of the sacrum is tilted forward and its lower end backward, the antero-posterior diameter at the inlet being thus diminished while that of the outlet is increased. As a result of the study of the foregoing facts, and by imitating the methods of nature, the obstetrician is able to produce at will an increase of the conjugate diameters of either the inlet or the outlet of the pelvis. The fact is utilized in normal labor, as I have already noted. It is also, as we shall presently see, of great value in the conduct of operative deliveries. The pelvic inclination varies according to the position of the woman, and may, of course, be abnormal in cases of pelvic deformity. This variation is dependent upon the motion which exists at the sacro-iliac joints, the pelvic brim swinging a little upward and downward according to the position of the patient.

Separation of the knees, by increasing the tension of the ilio-femoral ligaments, increases the angle of inclination. The normal pelvic inclination in the standing position is from 50 to 60 degrees (Fig. 1042). The pelvic inclination in the dorsal position with the legs extended is 30 degrees (Fig. 1043); in the dorsal position with the thighs and legs flexed and heels close to the buttocks with knees moderately separated it is 40 degrees (Fig. 1045); while in the dorsal position with the thighs strongly flexed upon the abdomen and the knees widely separated, namely, the exaggerated lithotomy position, the angle is 60 degrees (Fig. 1047).

1. **The Walcher Posture** (Fig. 1046).—This is the opposite of the exaggerated lithotomy position. The patient is placed on her back in the "cross-bed" position, or preferably on a table, in such a manner that the sacrum rests upon the edge of the table, the thighs and legs being allowed to hang downward by their own weight. In this position the pelvic inclination is increased and the conjugate diameter of the pelvic inlet slightly increased. The vaginal outlet

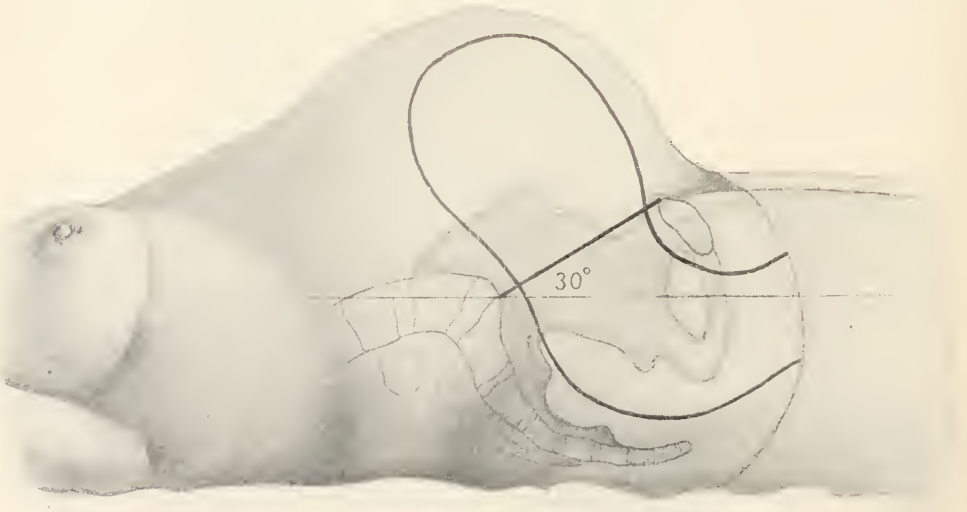


FIG. 1043.—DORSAL POSTURE WITH EXTENDED THIGHS, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION.—(*From a photograph taken at the Emergency Hospital.*)

is drawn so far down that the angle formed by the long axis of the uterus with that of the vagina is diminished, and the utero-vaginal canal becomes less curved and approaches a straight line (Fig. 1046). Manual manipulations are thus much facilitated. According to Walcher,* the conjugate is increased from 0.33 to 0.5 inch (8.5 to 13 mm.). Fothergill estimates the average difference between the conjugate in the lithotomy position and the same measurement in the Walcher position as 0.36 inch (9.3 mm.). At the New York Maternity, in 1898, I measured several series of cases from among the waiting women with a Farabeuf pelvimeter (Fig. 214) in the lithotomy position with moderate flexion of the thighs, and then in the hanging Walcher posture. A gain in the true conjugate with the latter position was readily demonstrated. This increase in the true conjugate varied from one-fourth to one-half an inch (0.635 cm. to 1.27 cm.), averaging higher in multigravidæ than in primigravidæ. The mechanism of

*"Ctbl. f. Gyn.," 1889, S. 892.

the Walcher position is dependent upon the motion of the sacro-iliac synchrondrosis, and is explained as follows: The weight of the limbs hanging from the edge of the table causes the ilia to rotate forward and downward around the transverse axis of the joint. Thus the angle made by the plane of the brim with the horizon is increased, and consequently the symphysis pubis is brought a little forward and downward and a little further from the sacrum. (See Fig. 1046.) It should not be forgotten that the Walcher position may be utilized in breech presentations as well as in vertex.*

2. Exaggerated Lithotomy Posture (Fig. 1047).—Dorsal postures are subdivided in accordance with the position of the legs. If the latter are horizontal, the angle of the inlet is 30 degrees (Fig. 1043). If the thighs and legs are flexed, the feet resting on the table, the angle increases to 40 degrees (Fig. 1045); and if the degree of flexion is extreme, the patient being in the exaggerated lithotomy

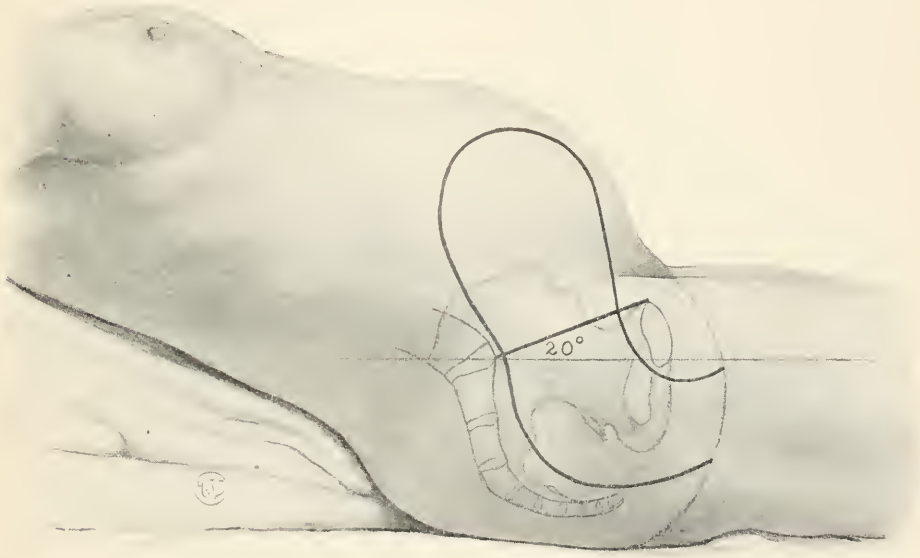


FIG. 1044.—DORSAL POSTURE WITH ELEVATION OF THE THORAX, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION.—(*From a photograph taken at the Emergency Hospital.*)

posture, the angle is 60 degrees (Figs. 1047, 1048). With increase in the size of the angle of inclination, the fundus tilts backward more and more, while the lower portion of the birth canal is correspondingly elevated. The angle of the two portions of the birth tract, uterine and vaginal, appears to undergo but little change during flexion of the limbs. The dorsal position with extreme flexion of the limbs is indicated for slight degrees of obstruction at the pelvic outlet and for all operations after the head has passed the brim.

2. POSTURES WHICH ELEVATE THE PELVIS.

These are four, in two of which the woman is prone, knee-chest and exaggerated lateral prone, in the others, supine, Trendelenburg and Trendelenburg-

* The Walcher position was described and illustrated in Italy many years ago. Its use, however, was purely empirical. It was supposed to make the child more movable and to be useful in the delivery of fat patients. It remained for Walcher to demonstrate the mechanism involved and thus to place the matter upon a scientific basis.

Walcher. The general result of these high pelvic positions is naturally one of gravitation. The pelvic viscera sink toward the diaphragm, and the result from the obstetrical standpoint is twofold. First, the fetus sinks away from the cervix, with the result in the first stage that the uterine contractions are diminished in force and frequency. The second consequence of the high pelvic postures is that the pelvis becomes more ample, so that the entire hand may readily be introduced. The combined results of elevation of the pelvis give the obstetrician a high degree of control over certain phenomena of normal and pathological labor. He can delay rupture of the bag of waters, antagonize over-strong pains, facilitate certain manœuvers which are best done with the entire hand in the vagina, and prevent the redescent of the small parts of the fetus.

1. **Knee-chest Posture** (Fig. 1049).—Sims,* in his original description of this position, states that the woman should first kneel and then bend the body

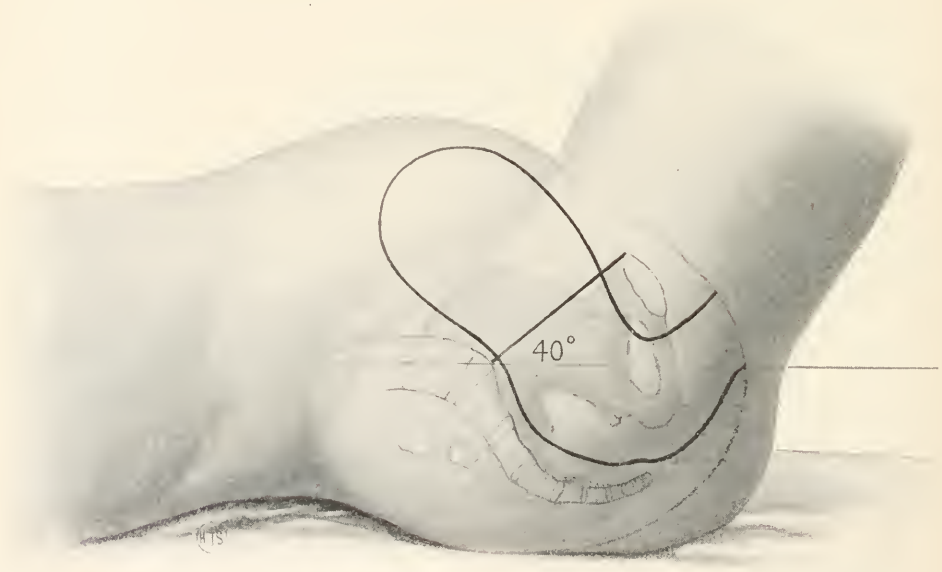


FIG. 1045.—DORSAL POSTURE WITH MODERATE FLEXION OF THE THIGHS, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION. Note the slight upward rotation of the symphysis and enlargement of the pelvic outlet.—(*From a photograph taken at the Emergency Hospital.*)

forward till the head reaches the level of the table, where it should rest upon the two hands. The weight is supported by the left parietal bone, the elbows being thrown out widely at the sides. The knees should be 8 or 10 inches (20.32 or 25.4 cm.) apart and the thighs should form nearly a right angle with the table. The woman thus supported should remain perfectly quiet, only the necessary muscles being contracted. After a few moments' interval the abdominal and pelvic viscera gravitate toward the epigastrium. It is apparent that in the knee-elbow position the weight in front is supported upon the forearms, while a knee-chest position is impossible unless pillows are placed beneath the chest.

2. **Latero-prone Position with Elevated Hips** (Figs. 1050 and 1051).—This is perhaps superior, in filling certain indications, to both the knee-chest and

* "Clinical Notes on Uterine Surgery."

Trendelenburg positions. It is far more acceptable to the patient, who can assume it for an indefinite period. She may lie at first in the ordinary lateral decubitus and then have one side of the pelvis gradually elevated by slipping cushions under the hip. Other cushions are placed beneath the head and chest, as these structures support the weight in front. The woman rests upon the side of the head, the entire breast, and the side of one knee. The elevation of the buttocks appears to equal, for all practical purposes, that produced by the Trendelenburg and knee-chest positions. Obstetricians of a bygone age (Deventer, Ritgen) counsel the employment of this attitude, although they seem to regard it as a makeshift for the more efficacious but hardly endurable knee-chest posture. It is probable that they did not attempt to

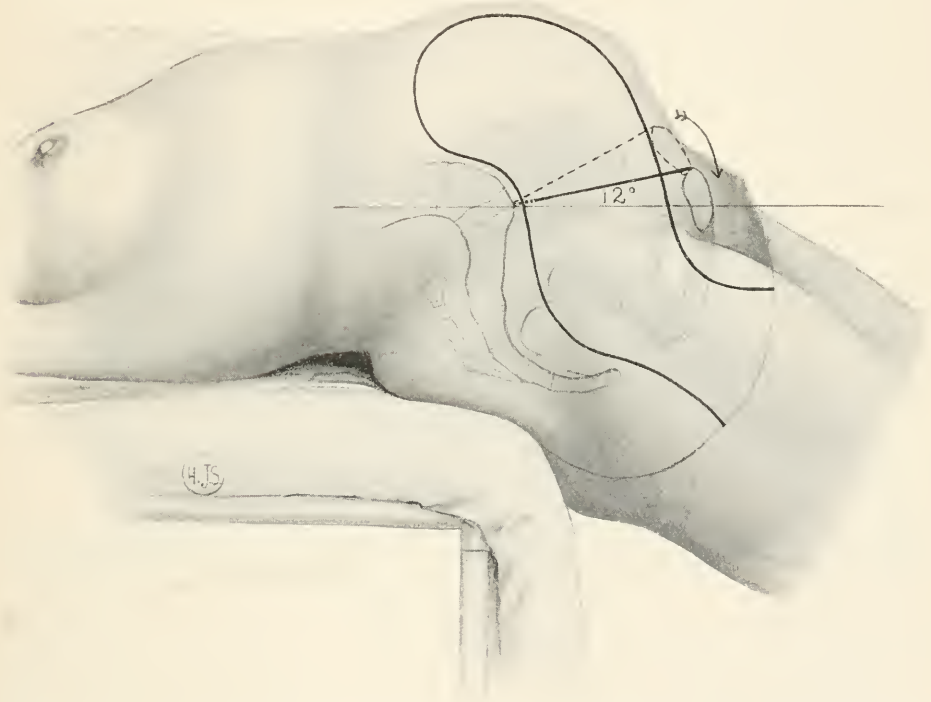


FIG. 1046.—WALCHER POSTURE, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION. Note the downward rotation of the symphysis and the enlargement of the pelvic inlet.—(*From a photograph taken at the Emergency Hospital.*)

elevate the pelvis beyond a certain limited height. The superiority of the exaggerated latero-prone position lies in its adaptability and modesty as compared with the knee-chest position. For many years I have used it in my practice to the exclusion of the uncomfortable knee-chest posture.

Indications for the Knee-chest and Exaggerated Lateral Prone Postures.—These two postures are of service during pregnancy, labor, and the puerperium. In pregnancy they are useful for external ballottement and also for exploring the sides of the pelvis. Generally speaking, examinations in these positions give results which supplement those obtained by exploration in the dorsal attitude. From a therapeutic standpoint the postures are of some use in procuring temporary relief from all conditions which arise from pressure of the gravid uterus on the tissues beneath (hemorrhoids, constipation, vesical trouble, obstruction

of ureters, etc.). Late in pregnancy the woman may systematically assume these positions at stated intervals. Early in the course of gestation it is sometimes possible to relieve the vomiting of pregnancy by this means. For one complication of pregnancy, retrodisplacement of the uterus, this postural treatment is indispensable, although manual reposition is used as an accessory measure. (See page 278.) In labor the assumption of the knee-chest or lateral prone position arrests contractions for the time being. In normal labor there is no very strong indication for the assumption of these positions. They directly antagonize the action of gravity in promoting labor, and are thus distinctly contraindicated in the first stage. In theory they might be indicated when precipitate labor is threatened, and in attempts to defer rupture of the bag of waters. There is no indication for forceps delivery in these postures, but

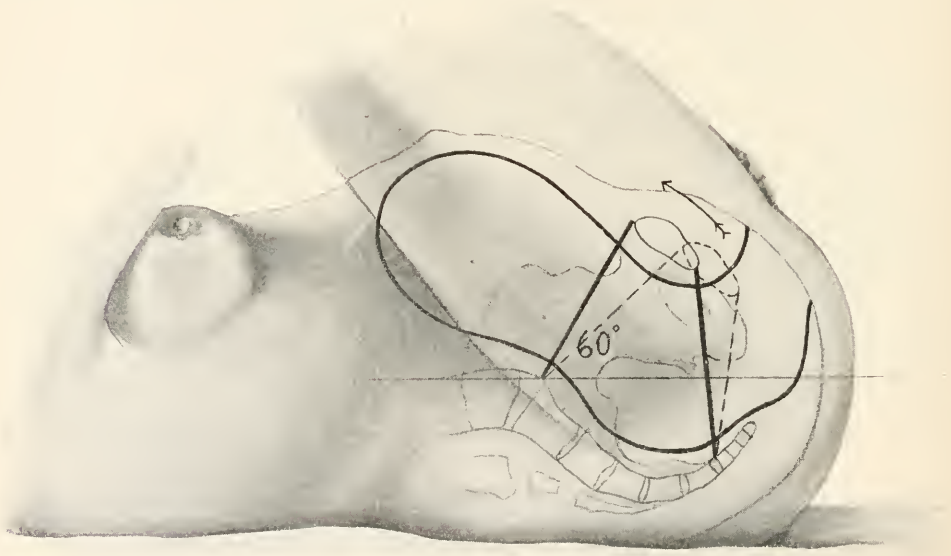


FIG. 1047.—DORSAL POSTURE WITH EXTREME FLEXION OF THE THIGHS, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION. EXAGGERATED LITHOTOMY POSITION. Note the extreme upward rotation of the symphysis and the enlargement of the pelvic outlet, and diminution of the pelvic inlet.—(*From a photograph taken at the Emergency Hospital.*)

in version they present numerous advantages: (1) The uterus sags away from the pelvis, giving the operator more room to introduce his hand; (2) labor pains are arrested for the time being, and (3) there is a natural tendency on the part of the knee-chest position to favor the rectification of the malposition for which version is required. These postures are most valuable in connection with prolapse of the funis, yet in this manual replacement must generally be employed as an adjunct. In 1882 Galbraith brought about the unlocking of twins by causing the mother to assume the knee-chest posture. In theory, at least, the latter should favor the reposition of an inverted uterus.

Of the hanging dorsal or Trendelenburg, and the arched dorsal or Trendelenburg-Walcher positions, the latter is but little known, having been but recently revived from mediæval obscurity by Dr. R. L. Dickinson. The pelvic elevation is very slight in the latter, and it might perhaps be better described as a hybrid

posture in which the size and height of the pelvis are simultaneously affected. Each position is described in detail.

3. Trendelenburg Posture (Fig. 1052).—While this posture appears to be a lineal descendant of an old method of applying taxis in hernia, its use has become general only of late years, so that the knee-chest position is very much its senior in obstetric practice. A woman in the Trendelenburg position lies upon her back with her head and arms flat upon the operating table while the rest of her person is elevated to an angle of 45 degrees or less, except the legs, which hang over the foot of an inclined plane. The weight of the body is supported by the head and knees (Fig. 1052). If the angle of elevation attains a certain size, it is necessary to strap the legs. This posture may be improvised in various ways: thus, an incline may be formed from an inverted chair and several pillows,

FIG. 1048.—EXAGGERATED LITHOTOMY POSTURE.

or the woman may rest, head down, upon the back of a strong attendant with her knee hollows upon his shoulders and her legs held in his hands. This was the earliest application of the method. The Trendelenburg position is used extensively in the laparotomies incidental to obstetrical practice, as in ectopic pregnancy. Aside from this, it has been proposed as a substitute in certain cases for the knee-chest position. Its advantages over the latter are that it is more natural and modest, and can be endured indefinitely, thereby antagonizing a further tendency to prolapse of the small parts. It does not conflict with the administration of anesthesia.

4. Walcher-Trendelenburg Posture (Fig. 1053).—In the Walcher position as usually assumed, the direction of the axis of the utero-vaginal canal is almost perpendicular, and traction with the hand or forceps must be directly downward. For this reason a combination of the Walcher position with the well-

known Trendelenburg is advised.* In this way the advantages of the former position are realized while the vulva is at such a height that traction can conveniently be made. The axis of the utero-vaginal canal is horizontal and manipulations are thus facilitated. A satisfactory table for this position may be improvised by means of an ordinary inverted chair and a mattress.

Conclusions.—From the foregoing the following conclusions may be deduced: (1) When the head is arrested at the pelvic brim, either the Walcher or the Walcher-Trendelenburg position is worthy of trial. (2) For all operative cases in which the greatest circumference of the head has passed the brim, the exaggerated lithotomy position is to be preferred.

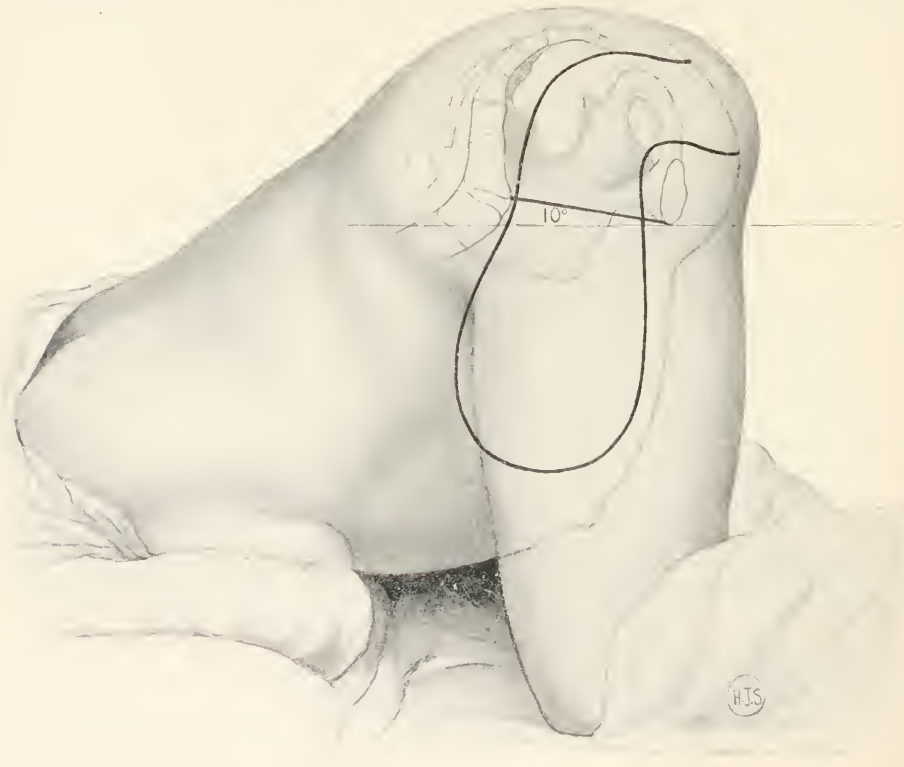


FIG. 1049.—KNEE-CHEST POSTURE, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION.—(*From a photograph taken at the Emergency Hospital.*)

Posture as an Aid to Childbirth.—In *retroversion* of the pregnant uterus the patient should be placed in the knee-elbow or the exaggerated latero-prone position, in order that reposition of the uterus may be attempted. In *over-strong pains*, to prevent precipitate labor the patient should be placed upon her side and forbidden to bear down. In labor in *contracted pelvis*, with slight disproportion between the head and inlet, Walcher's position should be assumed during engagement in the inlet. If a similar degree of contraction exists at the outlet, the exaggerated lithotomy position should be assumed. In the *first stage of labor* posture is generally left to the decision of the parturient. She may be seated or may

* Dickinson: "American Journal of Obstetrics," Dec., 1898, p. 791

walk about. An upright position is held to be of advantage because the weight of the fetus may stimulate the cervix to dilate. However, when dilatation is nearly complete there is some danger of precipitate expulsion, with possible

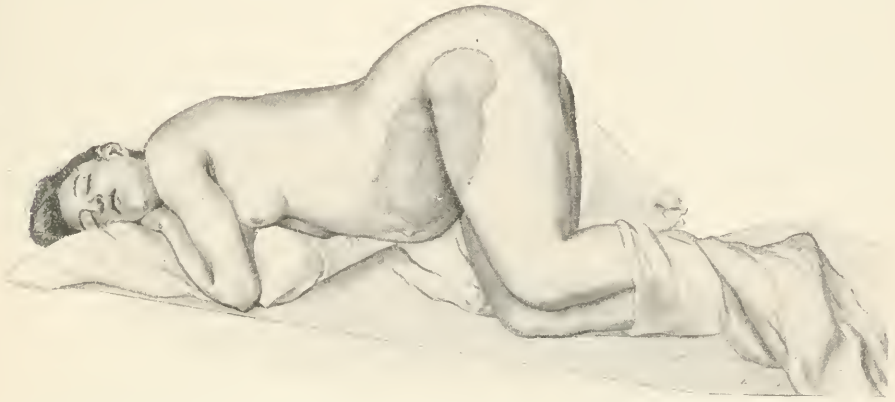


FIG. 1050.—EXAGGERATED LATERAL PRONE POSTURE. ANTERIOR VIEW.—(*From a photograph taken at the Emergency Hospital.*)

rupture of the cord or injury to the child. It has been suggested as a compromise that the woman should squat or kneel during the latter part of the first stage, for she thereby retains the benefit of the upright position without the risks just enumerated. In the *second stage of labor* the natural tendency

FIG. 1051.—EXAGGERATED LATERAL PRONE POSTURE. POSTERIOR VIEW.—(*From a photograph taken at the Emergency Hospital.*)

during the expulsion period is toward the assumption of the dorsal position. It has been ascertained that a reclining attitude facilitates the first half of the second stage, while during the second half the woman should turn on that

side toward which the fetal back presents, with her legs strongly flexed. This position is believed to favor perfect flexion of the child's head. It is used almost universally in Great Britain throughout the second stage. While conducing to modesty, it also lessens the intensity of the expulsive forces during perineal dilatation by bringing gravity into play. In the *third stage of labor* the woman should lie flat on her back with the head low. In *occipito-posterior positions* before labor has set in, the woman should assume the knee-chest or latero-prone position with elevated hips in the hope that the head will engage in the natural way. After labor is under way she should assume the latero-prone position on the side toward which the fetal back is directed. In *mento-posterior positions* the patient should be placed on the same side as that toward which the fetal abdomen is turned. This posture favors the desired extension and anterior rotation of the chin. With *prolapse of an arm*, after the head has been pushed up, the

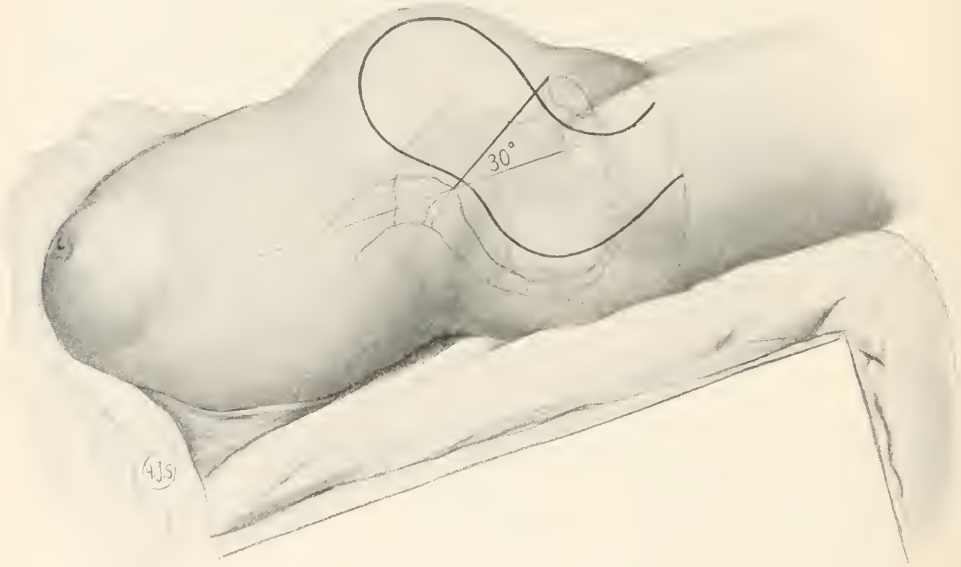


FIG. 1052.—TRENDELENBURG POSTURE, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION.—(*From a photograph taken at the Emergency Hospital.*)

uterine obliquity usually present is corrected by having the patient lie on the side opposite to that to which the fundus inclines. The head should now be able to engage without the arm. With *presentation and prolapse of the cord* our resource is often posture. The patient should be placed in the knee-elbow or exaggerated semi-prone posture for ten minutes. The head then falls away from the os and sinks into the cavity of the uterus. Actual prolapse of the cord requires the same postural treatment. With *short cord* the mother may assume a squatting or kneeling posture (page 559).* In *heart failure* an asystolic woman can often be safely delivered in a reclining attitude with the thorax raised and afterward may regain some compensation (Fig. 1044). It is held that this position aids the failing heart and respiration by removing some of the pressure from the diaphragm. In *post-partum hemorrhage* the patient should be flat on her back without pillows and the foot of the bed elevated. This posture is indicated also in ante-partum

* Brickner: "Am. Jour. Med. Sciences," Nov., 1899.

and intra-partum hemorrhages. In *forceps delivery* the patient is usually placed in the lithotomy position. In England she lies in the ordinary obstetrical position, upon the left side. The English and American methods can be combined by applying the blades in the former and extracting in the latter position. In very difficult extraction the Walcher position may be employed until the head has passed the inlet, after which the lithotomy position is assumed. In *version* the woman is placed in the Trendelenburg, Walcher, Trendelenburg-Walcher or exaggerated lithotomy position according to the stages and difficulties of the operation. In dorso-posterior positions one may employ the latero-prone position, the woman lying on the side at which is the fetal pole which is to be brought down. In case the presenting part is firmly engaged in the inlet, the

FIG. 1053.—TRENDELENBURG-WALCHER POSTURE, SHOWING THE PARTURIENT TRACT AND THE DEGREE OF PELVIC INCLINATION. Note the downward rotation of the symphysis and the enlargement of the pelvic inlet.—(*From a photograph taken at the Emergency Hospital.*)

knee-elbow position may be used, although I have found the exaggerated latero-prone or Trendelenburg posture to answer better. In the *puerperium*, for the first two or three days the dorsal posture is advisable (page 694). After the third day the patient's time should be equally divided between the dorsal, two lateral, and if possible the abdominal posture (flat on belly) (page 694). Drainage is promoted by an early propping up of the shoulders.

V. VAGINAL EXAMINATION.

See Asepsis in Obstetrics, page 148.

VI. DIGITAL EXPLORATION OF THE UTERUS.

This procedure is often necessary in the diagnosis of incomplete abortion and septic conditions, and is performed as follows: The patient is placed in the lithotomy position, the operator's hands and arms and the vulva are carefully disinfected, and the vagina is irrigated. Two fingers of the right hand are then introduced into the vagina and passed through the cervix, the left hand meanwhile being placed upon the fundus and the uterus being pressed downward and backward into the axis of the bony pelvis (Fig. 1054). In this way the

FIG. 1054.—DIGITAL EXPLORATION OF THE UTERUS.

uterus may be pressed over the examining fingers like a glove. The anterior, posterior, and lateral walls of the uterus are then to be systematically palpated, especial attention being paid to the cornua, where retained decidua, chorion, or placenta is apt to escape notice (Fig. 1054). The condition of the uterine walls is thus appreciated and the presence or absence of placenta or membranes noted. In some cases it may be necessary to introduce the entire hand into the uterus. This can be done only when the patient has been recently delivered and the cavity is of sufficient size. If the patient is unusually nervous or sensitive, primary anesthesia will first be necessary.

VII. VULVAL DOUCHE.

It is often important that the vulva should be flushed out thoroughly in its inner aspect and not merely washed on the outside, as is the ordinary custom. The inside of the vulva, in marked contrast with the vagina, is the habitat of many germs, and in certain cases infection may be due to micro-organisms from the vulva carried into the birth tract on the exploring finger. The vulval douche is therefore intended to cleanse the inner aspect of the external genitals. The woman should lie on her back upon a douche pan or a Kelly pad with limbs somewhat abducted (Fig. 1048). The labia majora are held wide apart by the fingers (Fig. 1055), while by the aid of an ordinary irrigation apparatus a stream of water is directed through a glass nozzle upon the labia minora, clitoris, vestibule, and other parts comprising the vulva. The cleansing can also be accomplished after wide opening of the vulva with pledgets of absorbent cotton first dipped in a soap solution, then in sterile water, and finally in an antiseptic, such as a lysol or sublimate solution. *To avoid rectal contamination, the sponging should always be from above downward.*

FIG. 1055.—THE VULVAL DOUCHE.

VIII. VAGINAL IRRIGATION.

In this, as in all other obstetric procedures, every care should be taken to prevent the introduction of infection. The vulva and adjacent regions and the hands of the physician should be cleansed as before a vaginal examination. (See Asepsis in Obstetrics, page 150.) The patient should be in the dorsal position; a glass or metal tube which can be sterilized by boiling is to be preferred (Fig. 1057). The intrauterine tube may be used, but a straight tube is less likely to enter the cervix or to carry fluid into the uterine cavity. In all cases, as in vaginal and uterine manipulations, the vulval canal should first be obliterated with the free hand before the introduction of the irrigating tube (Fig. 1056). Special attention is to be directed to the posterior cul-de-sac, where there is apt to be an accumulation of stagnant secretions. Special care is to be taken also that the tube does not enter the cervix and that infectious secretions are not washed into the uterus. If necessary, a finger in the vagina should be employed to make sure that the uterine cavity is not invaded. A common practice in recent years has been tightly to close the vaginal outlet about the irrigating tube, in order to increase the intravaginal pressure, balloon the walls, and secure a more thorough cleansing. This in the presence of a puerperal uterus must be employed with caution, and never without a firm grasp of the fundus, and only with moderate increase of intravaginal pressure.

A fountain syringe is to be preferred for vaginal as for intrauterine injections. The temperature of the solution should be from 105° to 110° F. There is no advantage in a high degree of heat unless hemorrhage exists. The resorptive power of the vagina soon after delivery is greater than has generally been supposed. Stronger sublimate solutions than 1 : 5000 should not be used. For the various solutions to be used in vaginal as well as intrauterine injections, see Treatment of Puerperal Infection (page 726). Valuable ones are, 1 : 5000 sublimate; 2 per cent. carbolic acid; 0.5 per cent. lysol or creolin; decinormal saline solution, and plain sterile water.

FIG. 1056.—THE VAGINAL DOUCHE.

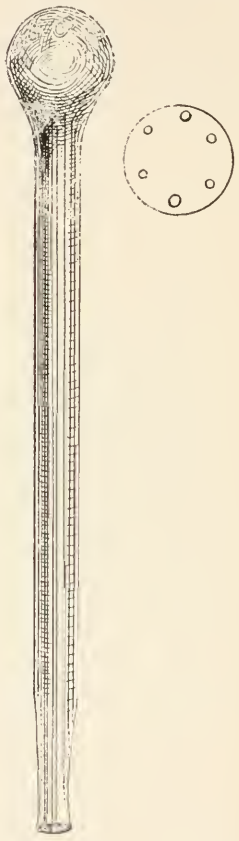


FIG. 1057.—BLUNT VAGINAL DOUCHE TUBE.

IX. INTRAUTERINE IRRIGATION.

An intrauterine injection is by no means an indifferent procedure, and should be regarded as an operation—one to be performed with scrupulous care and attention to detail. The following are the sources of danger. Shock from uterine distention or from too hot or too cold solutions; poisoning, *e. g.*, by bichloride of mercury or carbolic acid; abrasions of the soft parts resulting in new foci of infection; dislodgment of clots from the puerperal venous

sinuses which may enter the general circulation, and entrance of fluid into the Fallopian tubes and peritoneal cavity.

The intrauterine douche tube should be of glass or metal, that it may be sterilized by boiling, should be of medium caliber, and have a suitable curve (Fig. 1059). Tubes of tin, the shape of which can be altered at will, are convenient, and metal male catheters may be used in an emergency. The tube should be perforated at the sides and there should be no opening at the end. The current of fluid should be continuous, not interrupted; a fountain syringe

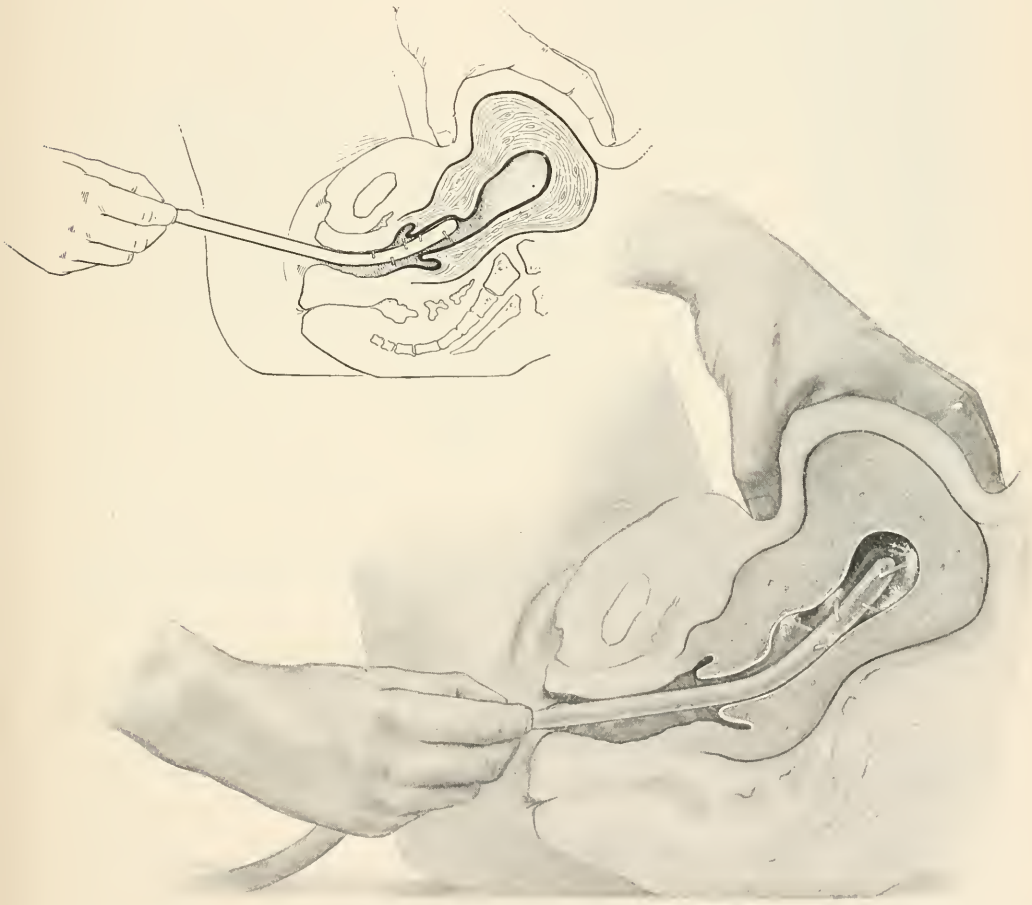


FIG. 1058.—INTRAUTERINE IRRIGATION. The upper illustration shows a faulty method. Note the firm grasp of the fundus.

is to be preferred, and every care should be taken to prevent the entrance of air. The douche bag should be held at such a height that the current is sufficient but not strong, two or three feet above the patient's pelvis being usually the proper height. The quantity of fluid may vary with the indications, less than one quart being rarely used. *Solutions:* Within the uterus we irrigate with plain sterile water or sterile decinormal saline solution; 0.5 per cent. of creolin or lysol, 50 per cent. alcohol, and sublimate solution in the strength of 1 : 10,000, which last should be followed by a second irrigation of plain

sterile water. *Administration:* The patient should be in the dorsal position, and, when practicable, in the lithotomy position. As stated elsewhere, a recently delivered patient should never be placed in the Sims position on account of the danger of the entrance of air into the uterine sinuses. It is rarely necessary, nor is it advisable, to introduce the finger into the vagina as a guide to the cervix. The external genitals and hand having been cleansed, the physician sits or stands at the side of the bed or in front of the patient, and with the fingers of the free hand obliterates the vulval canal by placing the outer border of the thumb upon the inner aspect of one labium and the first and second fingers upon the inner surface of the opposite labium, and widely separates them (Fig. 1056). The irrigating tube is then passed directly into the vagina and first a thorough vaginal irrigation is administered, during which the free hand firmly grasps the fundus. The fundus is then pushed backward, and by the sense of touch the irrigating tube is passed on into the uterus, always remembering to keep a firm grasp upon the fundus to prevent dilatation of the uterus and opening of the sinuses (Fig. 1058).

Fig. 1059.—Author's Return Flow Vaginal and Uterine Irrigating Tubes.

The tube should be carried to the fundus, and care should be taken that the soft tissues of the uterine wall are not injured by rough or careless movements. Some instruments—*e. g.*, the Fritsch-Bozeman intrauterine catheter, and the author's irrigating tube—provide for the return of the fluid, but this may be promoted, if necessary, whatever instrument is used, by gentle pressure with the instrument against the anterior lip of the cervix. During the entire process the patient should be carefully observed, and at the first evidence of pallor or twitching of the facial muscles, or of pain or constitutional disturbance, the injection should be stopped. If there is uterine hemorrhage, showing the dislodgment of a clot, the injection should be suspended. Retained fluid is best expressed by compression of the fundus.

X. THE VAGINAL TAMPON.

This is best applied with the patient in the Sims position and the perineum drawn back by a speculum. The dorsal posture and a perineal retractor can also be used. The external genitals should be disinfected and the vagina carefully swabbed out with a piece of gauze soaked in an antiseptic solution. The tampon should preferably be of gauze, but in the absence of this material may be of absorbent cotton or lamp-wick, soaked in an antiseptic solution. The use of plain sterile gauze is not advisable owing to the danger of decomposition of retained secretions. In order to be efficient, the tamponing should be done carefully and thoroughly. It requires from thirty to forty yards of four-inch moist gauze to properly tampon the vagina in placenta prævia. The vaginal

fornices should first be packed, and as the speculum is gradually withdrawn the rest of the vagina is filled (Fig. 1060). The tampon is held in position by a rather tight-fitting T-bandage (Fig. 271). It should not remain in place more

FIG. 1060.—THE VAGINAL TAMPON.

than twelve hours. At the end of this time it should be removed, and a second tampon introduced and left for another twelve hours.

XI. THE UTERINE TAMPON.

As stated elsewhere, the intrauterine tampon is used for the purpose of controlling hemorrhage and occasionally in the treatment of septic conditions. The method of procedure is as follows: The patient being in the lithotomy posture, the vulva and adjacent regions are cleansed and the vagina is irrigated; the perineum is depressed with an ordinary retractor; the anterior and posterior cervical lips are seized with volsella forceps or tenacula and the uterus is drawn down and held by an assistant (Figs. 1061 and 1062). A long strip of gauze is now passed into the uterine cavity by means of a long, blunt-pointed dressing forceps. The strips should be a hand's-breadth in width and folded, and about three or four yards in length, for the full-term puerperal uterus, and correspondingly smaller for the earlier months. Unmedicated sterile gauze is to be preferred. Every precaution should be taken to prevent infection, and the gauze should be carried by the dressing forceps directly from its special receptacle into the uterus without touching any foreign body which might contaminate it. During the entire operation the dressing forceps holding the gauze should be guided and controlled by the external hand grasping the fundus,

which makes sure that the gauze has reached the fundus. The gauze is gradually introduced, the object being completely to fill the uterine cavity from above downward (Figs. 1061 and 1062).

A loose packing is left in the vagina. If, however, in cases of hemorrhage, the bleeding comes from the lower uterine segment, as in some cases of placenta prævia or cervical laceration, the vaginal packing should be tight.

FIG. 1061.—METHOD OF PACKING THE PUERPERAL UTERUS.—(*From a photograph.*)

FIG. 1062.—METHOD OF PACKING THE PUERPERAL UTERUS.

In some cases the uterus may be pressed down so far that it is not necessary to draw it down by means of instruments, and if the latter are lacking, the gauze may usually be introduced by means of the hand being passed into the uterine cavity. If sterile gauze is not at hand, clean linen or other material which has been boiled and soaked in a disinfectant solution may be substituted in the case of grave emergency. A most convenient method for uterine as well as vaginal tamponade will be found in the use of a mechanical surgical dressing packer.* I have for several years in hospital and private work used two sizes, No. 3, outside diameter $\frac{3}{16}$ inch, for the puerperal uterus of

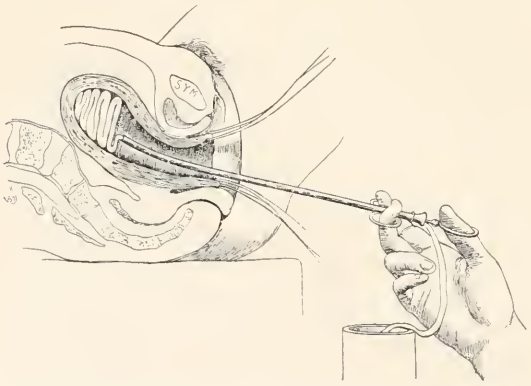


FIG. 1063.—PACKING THE PUERPERAL UTERUS WITH A METAL GAUZE-PACKER.

* Darmack patent.

the early months, and for packing the lower uterine segment to induce abortion; and No. 4, outside diameter $\frac{2}{5}$ inch, for packing the larger puerperal uterus and the lower segment to induce premature labor. No. 3 carries gauze from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches wide; No. 4, from 4 inches to 6 inches (see Figs. 1063 and 1069). To use the instrument, the lithotomy position, with the perineum retracted and the cervix held with volsella forceps, is to be preferred.

Hemorrhage coming on in from half an hour to an hour after the insertion of the uterine tampon indicates that blood is being squeezed from the gauze by uterine contractions. In such a case further tamponing is not indicated, but, rather, the removal of the gauze. The tampon should not be allowed to remain *in situ* for more than twelve hours, and its removal should usually be followed by uterine and vaginal irrigation with some non-toxic solution.

FIG. 1064.—GLASS CATHETER.

XII. PASSING THE CATHETER.

The patient is placed in the dorsal position with thighs rotated outward. The labia are held apart by the fingers of one hand (Fig. 1056), while with a pledget of cotton dipped in an antiseptic solution, such as 1 per cent. lysol, the vestibule is carefully wiped from above downward. A glass catheter (Fig. 1064), previously boiled, is then introduced into the meatus and the water drawn. Since antisepsis and asepsis have been elaborated, it is considered wiser to catheterize the woman by the aid of direct inspection than by the mere sense of touch. For special directions for using the catheter, see Affections of the Bladder in Pregnancy (page 318), Labor (page 478), and the Puerperium (pages 706 to 708).

(B) OPERATIONS PPEPARATORY TO DELIVERY.

I. ARTIFICIAL RUPTURE OF MEMBRANES.

This procedure is of such simplicity that it hardly deserves to be ranked as an operation. **Indications:** When the cervix is fully dilated and the bag of waters is still intact, the obstetrician may interfere. The amniotic fluid has completely discharged its function of aiding the first stage of labor and would constitute an impediment in the period of expulsion. In twin labors after the birth of the first child, the os being well open, the bag of waters of the second twin will be of no further service, and should be ruptured after a short interval of expectancy. When the bag of waters persists throughout labor, the membranes should be ruptured immediately lest the newly born child be asphyxiated. Artificial opening of the membranes is sometimes indicated with the os not fully dilated. Thus the bag of waters may prolapse through a partially open os,

and even descend to the level of the vulva. This has been termed the "sausage-shaped" protrusion of the bag of waters, and sometimes stands in causal relation to premature detachment of the placenta. On this account alone it may be necessary to rupture the membranes. Again, if there are adhesions between the cervix and membranes which cannot be separated by the finger, artificial rupture may be indicated. In placenta prævia lateralis the indication is for early rupture of the membranes in advance of dilatation, in order that the fetal head may descend and compress the lower segment (page 223). In premature detachment of a normally seated placenta the indication is the same (page 228). Finally, most cases of operative intervention require rupture of the membranes. **Technique:** The fingers should pinch up a fold of the membranes and tear it apart. If the membranes are very firm or tense, the rupture must be produced by scissors or dressing forceps, or any sterile pointed instrument.

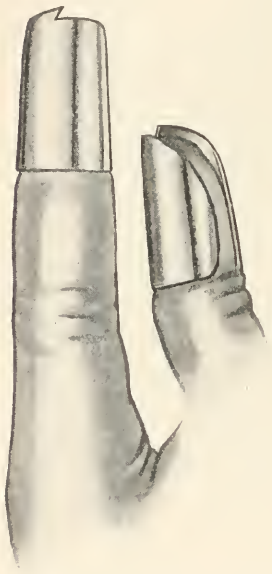


FIG. 1065. — NOTCHED THIMBLE FOR ARTIFICIAL RUPTURE OF THE MEMBRANES.

II. INDUCTION OF ABORTION AND PREMATURE LABOR.

Definitions.—The terms abortion and premature labor are applied with considerable looseness by various writers to express the termination of pregnancy at various periods before term. It seems logical, however, to draw the line at the approximate period of pregnancy at which the child is fitted for extrauterine existence, *i. e.*, the seventh month, and to divide abortions into early and late. An early abortion is one occurring within the first twelve weeks. Up to this time the ovum usually comes away in nearly a complete condition, while after the third month three stages of labor may be distinguished. It is advisable to make this distinction between early and late abortions, since the methods of treatment for each period are different. Induction of abortion is performed entirely in the interest of the mother; induction of premature labor may be done in the interest of either or both.

Importance.—For the conscientious physician the interruption of pregnancy naturally involves great responsibility, but when it is the only method of saving the life of the mother, or when without it her life is placed in imminent danger, it is usually regarded as not only justifiable but imperative. If possible, it should always be preceded by a consultation, which may not only prevent the unnecessary sacrifice of fetal life but protect the reputation of the physician.

Indications for the Induction of Abortion.—I am accustomed to make two groups of these indications, namely, (1) General, and (2) Local Indications.

1. Chief among the general indications is the *toxemia of pregnancy*, which shows itself chiefly in the early months, by the *persistent vomiting of pregnancy*. Although I am not convinced that all cases of persistent vomiting of pregnancy have an autotoxic origin, still I believe that a large proportion of these cases are due to a toxemia peculiar to pregnancy, possibly of hepatic origin. My custom is

to advise immediate induction of abortion in all cases showing marked toxic symptoms, and also in the milder type after stimulation of the functions of the liver, kidneys, and skin, together with colonic irrigations and rectal feeding fail to mitigate the symptoms. In instances of uncontrollable vomiting in which there is a possible neurotic or reflex cause, and in which decided toxic symptoms are absent, one is justified in using an expectant treatment, for a time, but never after food fails to be retained, emaciation becomes evident, and the pulse very rapid. Under these latter conditions a therapeutic abortion is not only justifiable but demanded, as too many lives have been sacrificed in the past by procrastination.

Renal insufficiency from *acute and chronic nephritis* usually asserts itself toward the last third of gestation, hence I have considered this condition under the induction of premature labor. The same indications, however, hold good in the first two-thirds of pregnancy.

Advanced cardiac and *pulmonary disease* have been considered on pages 325 and 331; and gestational mania, and neuroses, as *chorea*, on page 335.

2. Foremost among the local indications stands *pelvic contraction*. This only applies to absolute pelvic contraction (see page 659), as the operation has no place in relative pelvic contraction unless the latter be complicated by other maternal or fetal conditions demanding emptying of the uterus. In instances of absolute pelvic contraction the choice lies between induction of abortion and Cæsarean section, and in view of the excellent results attending the latter operation, it should be the operation of choice in these cases, unless other complications exist (see page 659). Induced abortion has no place in uncomplicated *ovarian tumors*, as we know to-day that such tumors can be removed by laparotomy without interrupting pregnancy, and this should be the treatment as soon as the diagnosis of the tumor is made (see page 604). In instances of *uterine myomata* complicating pregnancy, likewise, induced abortion rarely is indicated, as unless such tumors present urgent pressure symptoms pregnancy should be allowed to proceed to viability or term, and a hysterectomy performed either after spontaneous labor or Cæsarean section, the latter operation being possibly demanded by the tumor acting as an obstacle to delivery through the pelvis (see page 604). Therapeutic abortion is strictly contraindicated in *cancer of the uterus*. If the case is operable, immediate total hysterectomy is the operation of choice; disregarding entirely the existence of pregnancy. In inoperable cases pregnancy should be permitted to continue to viability or full term, and delivery completed according to the indications. In cancer of the cervix palliative measures in the interest of both mother and child may be resorted to during pregnancy (see page 610).

Irreducible uterine displacements, as *retroflexion*, *prolapse*, and *hernia of the pregnant uterus*, do occasionally require therapeutic abortion (see pages 278 and 281). Hemorrhage in the middle third of gestation may merely antedate a spontaneous abortion, but when such bleeding persists to an alarming extent without the expulsion of the uterine con-

FIG. 1066.—STERILE SOLID BOUGIE, FOR THE INDUCTION OF PREMATURE LABOR, CONTAINED IN SEALED GLASS TUBE.

tents therapeutic abortion is required, as the cause of the hemorrhage is probably a *placenta prævia* or the *premature separation of a normally situated placenta* (accidental hemorrhage).

Induction of abortion and irrigation of the uterine cavity is always demanded in those cases of unsuccessful attempts at *criminal abortion*, in which there is hemorrhage and possibly symptoms of sepsis as well (see page 360). The same may be said of instances of *missed abortion*, as soon as the symptoms of the *death of the fetus* can be determined (see page 358). *Hydatidiform mole* (see page 201) and *acute hydramnios* (see page 208) are also indications for the induction of abortion.

Indications for the Induction of Premature Labor.—These are principally on account of some condition or disease of the mother, as contracted pelvis or pregnancy toxemia, or, less frequently, because of some pathological condition existing in the ovum, as placenta prævia or habitual death of the fetus.

Endless discussion has arisen regarding the advisability of this operation in *contracted pelves*, several, as Pinard, Bar, and J. W. Williams, going so far as entirely to abandon the operation for this indication, and they permit their cases of relatively contracted pelves to go to term and then rely upon spontaneous labor, symphyseotomy, or Cæsarean section for delivery. This opinion is largely based upon the difficulty of determining with accuracy the comparative size of the fetal head, and of predicting whether sufficient plasticity of the head and strong uterine contractions will be present in a given case. From this opinion I most strongly dissent, for reasons already set forth in the Treatment of Pelvic Deformity (page 660), and especially because pelvimetry and cephalometry have in the past few years made such great strides toward accuracy that we can to-day draw very definite conclusions by our different methods of examination, concerning the relative size of a given pelvis and the fetal head. (See Pelvimetry and Cephalometry, pages 167 and 180.)

Pernicious anemia occurs with greater frequency in the pregnant woman than in the non-pregnant, although it is a very rare accident of gestation. Left to itself, pernicious anemia tends to terminate in premature labor or fetal death with eventual death of the mother. As this affection usually appears when pregnancy is well advanced, an opportunity is afforded to aid the chances of both mother and child by intervening soon after the diagnosis is made. The loss of blood will be considerably less than at term, and this fact alone is sufficient to establish the indication. The mother is known to have recovered in at least one such case.*

Pregnancy Toxemia.—The mild, often self-limited, type of toxemia does not always call for the interruption of labor. When this condition does not yield to treatment, and when the clinical picture is that of the acute or fulminant type, however, labor cannot be induced too soon. When the *preeclamptic state*, representing as it does a severe but not necessarily pernicious form of toxemia, does not subside or markedly improve under treatment, induced labor is indicated. In *acute* and *chronic nephritis*, even if the toxic symptoms can be held in control by suitable diet, hygiene, and medication, it must be remembered that eventually spontaneous premature labor is almost certain to result, and that the fetus of such a mother is usually very poorly developed, and not likely to survive. There is always the likelihood in the continuance of pregnancy of acute nephritis becoming chronic and of chronic nephritis rapidly progressing, hence in the event of toxic symptoms or renal insufficiency in these

*Stieda: "Ctbl. f. Gynäkol.," 1897.

cases, labor should be induced solely in the interests of the mother, those of the fetus being ignored.

In the *acute infectious diseases*, as typhoid, pneumonia, and in the *acute exanthemata*, spontaneous premature labor will often occur, but induction of labor is contraindicated, as nothing is gained for the child, and the prognosis for the mother is not bettered.

Pulmonary tuberculosis occasionally demands the operation (see page 331). For the induction of labor in *hydatidiform mole*, see page 201; in *hydramnios*, page 205; *placenta prævia*, page 222; in *cardiac disease*, page 325; and in *chorea*, page 335.

At one time induction of premature labor was frequently resorted to in instances of *uterine* and *ovarian tumors*. This is no longer justifiable nor proper (see page 604).

In rare instances, from the thirty-fourth to the thirty-eighth week, death of the fetus has occurred in successive pregnancies in women in whom nephritis and syphilis are absent as causative factors. Although the cause of this *habitual death of the fetus*, as it is termed, is unknown, it is justifiable to induce labor a week or so before the time at which fetal death occurred in previous pregnancies, in the hope of securing a living child. The procedure is occasionally successful.

In 2200 hospital cases I found it was necessary to induce labor in 19 cases, or 0.86 per cent., or once in 115.8 cases. The indications were: eclampsia, 4 cases; albuminuria, 4; pelvic deformity, 4; placenta prævia, 1; cardiac disease, 1; shoulder presentation, 1; pulmonary tuberculosis, 1; death of fetus, 1. The maternal mortality was in the 19 cases, as was the fetal mortality after the thirtieth week, *nil*. In one still-birth the operation was performed for dead fetus.

METHODS OF INDUCING ABORTION AND PREMATURE LABOR.

Various drugs have been used; *e. g.*, ergot, quinin, pilocarpin, ustilago the oils of tansy, pennyroyal, rue, savine and parsley, sulphate of magnesia and various irritant cathartics. Many of these drugs are dangerous and all are unreliable. They act chiefly by causing congestion of the pelvic viscera.

The vaginal douche or tampon, the intrauterine injection of water or glycerin, the artificial rupture or circular detachment of the membranes, and the use of electricity, are either too uncertain or dangerous as methods for the induction of labor, and have been to-day superseded by more reliable and safer methods.

Manual and Instrumental Dilatation of the Os.—Manual or instrumental dilatation of the cervix may of itself be sufficient to cause the premature interruption of labor, and it is a necessary part of many of the operations designed for that purpose (Figs. 1071 to 1093). Since, however, it is also a part of the treatment of difficult labor, and is in itself a distinct and important part of obstetric surgery, which merits separate attention, it will be considered by itself. (See page 895.)

Catheterization of the Uterus (Krause's Method).—The vagina and cervix are carefully disinfected. A solid bougie (No. 17 French or 12 English) is disinfected by boiling or steaming (Fig. 1066). The patient being in the lithotomy position, one or, if possible, two fingers of the operator's left hand are passed into the cervix, which has been drawn down by a volsella forceps (Fig. 1067). The bougie is passed by the right hand under the guidance of the fingers in the cervix, between the membranes and the uterine wall posteriorly, or in the direction of the least resistance, great care being taken not to rupture the

membranes or to separate the placenta (Fig. 1067). The bougie should be inserted to within a short distance of the fundus. Another bougie may be passed, if its introduction is easy, and a light vaginal packing of gauze will hold the bougie or bougies in place and protect the vaginal wall. The bougie is left to remain until labor is well under way. Labor usually begins in from twelve to twenty-four hours. In introducing the bougie after the formation of the placenta has occurred, care must be taken to avoid separation of the latter, desisting from pressure and passing the bougie in another direction

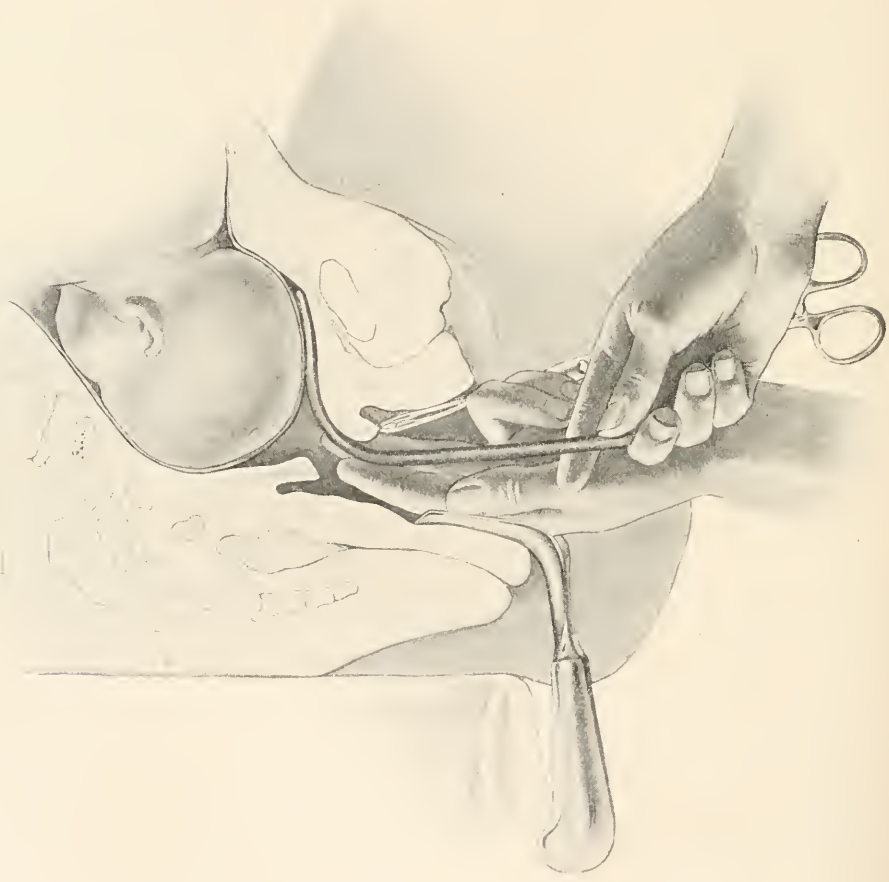


FIG. 1067.—INTRODUCTION OF A STERILE SOLID BOUGIE INTO THE UTERINE CAVITY FOR THE INDUCTION OF PREMATURE LABOR.

if resistance or hemorrhage is encountered. After introduction of the bougie the patient should remain in bed until uterine contractions begin. Now and then there will be a case in which active labor pains will not begin in twenty-four hours, and then the tampon and bougie should be withdrawn, a vaginal douche given, and a new bougie inserted in a position opposite to the first. Although one introduction is generally sufficient, several are sometimes required to produce the desired result, and, indeed, this method in certain cases fails altogether, though in general when time is not an object it is to be chosen

as the best and safest. Its chief danger is sepsis, and this is to be obviated by the most rigid antiseptic precautions. I am accustomed to combine Krause's bougie method with a gauze packing of the lower part of the uterus. The gauze, iodoform or plain, is rapidly run into the uterus after the introduction of the bougie with one of the modern cannula packers (see Fig. 1069) until slight resistance occurs. Vaginal packing is then accomplished with the same instrument, by simply withdrawing the end of the cannula from the os and continuing the packing in the vagina. I have never known this combined method to fail to induce labor within twelve hours.

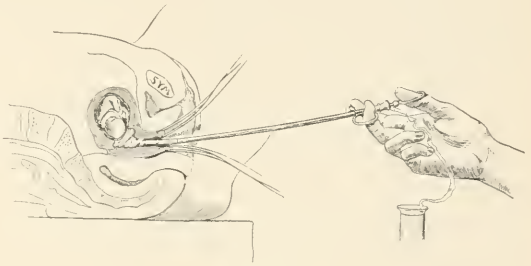


FIG. 1068.—MANAGEMENT OF INEVITABLE ABORTION. PACKING THE CERVICAL CANAL AND VAGINA WITH STERILE GAUZE.

Tamponade of the Vagina and Cervix.—The above method may be made considerably more effective by a preliminary tamponade of the cervix. After about the thirtieth week artificial dilatation is not usually necessary. Before that time the cervix may be dilated by Hegar's dilators or by the cautious use of one of the branched dilators until it will admit the finger. The cervix should then be packed with gauze and the vagina tamponed. (Compare page 884.)

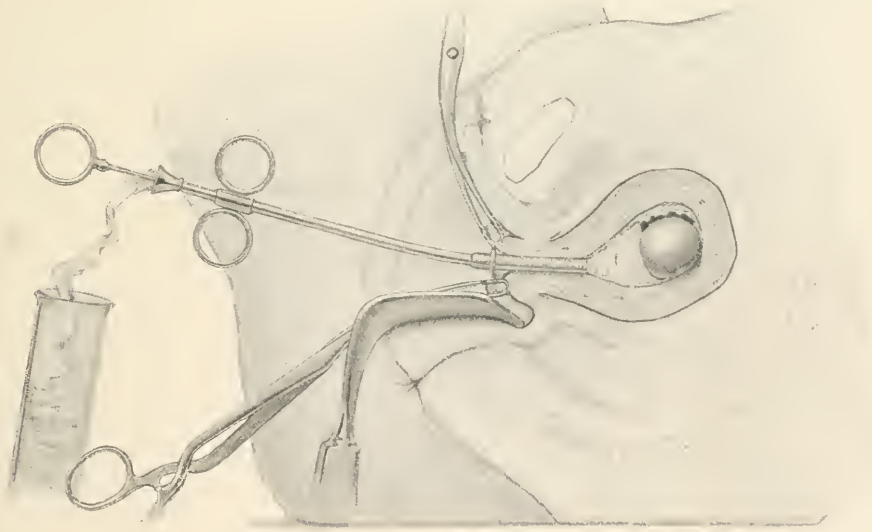


FIG. 1069.—INDUCTION OF ABORTION BY THE INTRODUCTION OF STERILE GAUZE INTO THE UTERUS WITH A CANNULA PACKER.

Tamponade of the Uterine Cavity.—This method acts in the same way as catheterization of the uterus, but affords a greater source of irritation and is very likely to prove effective. The cervix is dilated if necessary, and then, by means of a uterine packer, a tube through whose lumen a strip of gauze is pushed by a carrier (see Fig. 1068), a quantity of sterile gauze is forced between

the membranes and the uterine walls (Fig. 1069). The membranes separate without rupture, as the pressure exerted upon them by the mass of gauze is distributed over a considerable area. Unlike the bougie, the gauze cannot be introduced up to the fundus.

Hydrostatic Bags of de Ribes.—An excellent method for the induction of both abortion and premature labor is the introduction into the lower portion of the uterus of a Champetier de Ribes bag, or, better, one of its numerous modifications (Figs. 1093 and 1070). A certain amount of preliminary dilatation of the cervical canal is a necessity in this method. (Compare page 904.)

Methods Advised in Early Abortion of the First Third of Gestation.—*Rapid method:* The patient should be anesthetized and placed upon a table. After careful disinfection of the external genitals and vagina the anterior lip of the cervix is grasped by a volsella forceps and steadied by an assistant. The cervix is then dilated by Hegar's dilators or one of the branched dilators until it will admit the finger, which is then passed through the cervix while the external hand grasps the uterus through the abdominal wall and forces it downward in the axis of the inferior strait. The desideratum is the removal of an intact ovum, which cannot always be accomplished. An exaggerated lithotomy position and abdominal pressure are of the greatest assistance. If, however, the finger cannot be passed high enough to detach the ovum, an effort may be made to detach it by cautiously passing a dull curette between it and the uterine wall, when it may be removed by the finger or ovum forceps. If this cannot be done, it should be broken up and removed by the curette. (The technique of manual and instrumental curettage is described later.) The uterus should then be carefully but thoroughly curetted with the sharp curette and washed out with a non-toxic antiseptic solution, decinormal salt solution, or boiled water. If the operation has been aseptically performed, gauze drainage is superfluous. Some operators prefer to remove the fetus and then tampon. If after twenty-four hours the rest of the ovum does not come away when the tampon is taken out, they curette. As a rule, it is well for a good operator to curette at the first sitting. It should be remembered that in speaking of an intact ovum I mean simply that the bulk of the ovum has not been broken up. It is probable that complete separation of the decidua vera never takes place. For this reason the use of the curette is indicated even when the so-called intact ovum has been removed by the finger. *Slow method:* If the physician has not the necessary instruments or mistrusts his ability or operative skill, catheterization of the uterus may be tried, or the ovum may be circularly detached with the sound, or the cervix and vagina may be tamponed,

Fig. 1070.—Induction of Abortion with a Modification of Champetier de Ribes' Hydrostatic Bag.

or the last two expedients may be used together. A satisfactory, safe, and fairly prompt method is to place the patient in the lithotomy position, and after strict asepsis of vulva and vagina, retract the perineum, seize the anterior lip of the cervix with a volsella forceps, slowly dilate the os with Hegar's or a branched dilator until it admits the smaller gauze packer, and then pack the uterine cavity with plain sterile or iodoform gauze until resistance is encountered, and after packing the vagina apply a T-bandage (Fig. 1069). Separation and expulsion of the ovum into the upper part of the vagina usually occur within twelve hours. It is best to follow the expulsion of the ovum with curettage. For the introduction of the gauze, anesthesia is usually unnecessary.

Method Advised in Late Abortions of the Middle Third of Gestation.—After the third month, owing to the development of the supravaginal portion of the cervix and the commencing formation of the lower uterine segment, forcible dilatation without preliminary treatment is to be avoided. Catheterization of the uterus under strict asepsis, combined with the intrauterine tampon, is probably the best treatment. At this time the expulsion of an intact ovum is not to be expected. It is neither practicable nor safe to remove a retained placenta with the curette. It should be done with the fingers. The curette, however, is best adapted to the removal of the decidua. (See Management of Abortion, page 358.) (Compare accouchement forcé and instrumental and manual dilatation of the cervix, Part X.)

Method Advised in the Induction of Premature Labor.—In this procedure rapidity in emptying the uterus is not to be sought for except in cases of emergency, such as eclampsia and placenta prævia. It is best to imitate as closely as possible the phenomena of natural labor. Catheterization of the uterus combined with uterine and vaginal tamponade, or the insertion of a Champetier de Ribes bag or one of its modifications, offers the best means of exciting uterine contraction. Owing to the deficient vitality of premature children, however, great care should be used to avoid early rupture of the membranes. For the same reason labor should not be allowed to continue too long after rupture of the membranes, and a carefully conducted forceps operation, unless contraindicated, is less likely to be fatal to the child than is version. After uterine contractions have begun the natural forces should be allowed to complete the delivery, if possible. If catheterization with uterine and vaginal tamponade has been employed, and it is not equal to the task, cervical dilatation may be aided by the bag of Champetier de Ribes or by a partial manual dilatation, and after rupture of the membranes the engagement of the head and its further progress may be aided by external pressure (Fig. 1167). If the bags of Champetier de Ribes alone are employed, partial dilatation of the cervix must first be secured (page 902). Occasional traction upon the tube leading from the bag will often hasten the onset of pains. In the 19 cases already referred to, labor was induced with the intrauterine bougie alone in 7 cases; with the bougie and cervical and vaginal gauze packing in 2 cases; with cervical and vaginal packing in 2 cases; with Barnes' bags in 8 cases.

III. MANUAL DILATATION OF THE CERVIX.

This procedure is our resource when a serious emergency, arising in the presence of an undilated or but partially dilated cervix, makes immediate delivery a necessity. An important condition, however, should be noted. Under no circumstances should delivery by this method be attempted until the internal

os has disappeared or can be readily made to disappear (Figs. 1082 to 1085). Such an attempt exposes the patient to the most imminent danger of rupture of the uterus (Fig. 782). This method also presupposes a certain amount of dilatation, enough to admit the finger. It is rarely necessary, however, to resort to instrumental dilatation as a preliminary during the latter part of pregnancy. It is essential to the success of this method that the dilatation should be slow and gradual. Any attempt to overcome the resistance of the cervix by sudden force is likely to be attended by consequences of a most disastrous nature. As soon as the cervix is felt to contract around the finger, all efforts at dilatation should cease, to be resumed when it is felt to relax. The operator should remember that the cervix is a muscular organ and that its relaxation can but gradually be effected, and that the physiological softening caused by the alternate advance and retreat of the presenting part (Fig. 565) is absent.

Unimanual Dilatation.—It is not necessary to describe the various and practically unessential differences in the operation as practised by different operators

FIG. 1071.—UNIMANUAL DILATATION OF THE PARTURIENT OS.

FIG. 1072.—UNIMANUAL DILATATION OF THE PARTURIENT OS.

and described in different text-books. The method described by Harris is the best of this variety of dilatation. The methods are practically the same, and are all based, I believe, upon an erroneous idea of the mechanism of cervical dilatation. *Operation:* Perhaps the following will serve as an average description of the method as commonly used: One finger is passed into the os, and this is followed by the gradual insertion of the other fingers successively, finally of the thumb, and later by the expansion of the hand (Figs. 1071 and 1072). When the closed fist can be withdrawn through the os, the operation is regarded as complete. It will be observed that in this operation the natural method of dilatation is reversed, the dilatation during the greater part of the operation being from below upward rather than from above downward. Some advocates of this method advise that after the closed fist has passed through the internal os it should be drawn down at intervals against the resisting cervical ring in imitation of the advance and recession of the fetal head during natural delivery, also that when the closed fist can be drawn through the canal the highest attainable degree of dilatation has been reached. It is apparent, however, that the

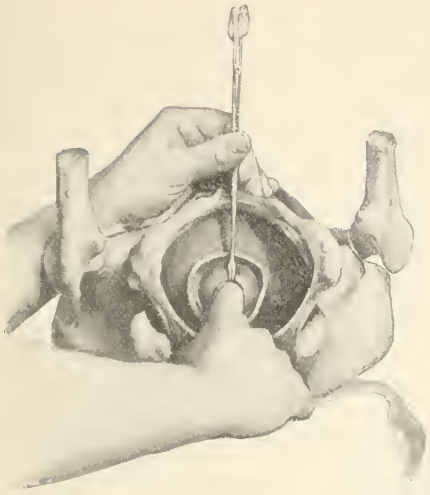


FIG. 1073.

FIG. 1074

FIG. 1075.

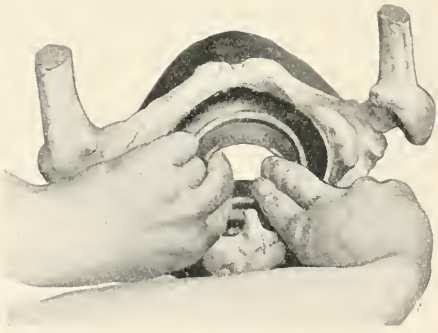


FIG. 1076.

FIG. 1077.

FIG. 1078.

FIGS. 1073–1078.—BIMANUAL DILATATION OF THE PARTURIENT OS.

size of the closed fist is a variable quantity, and that it is by no means a standard of the degree of dilatation attainable by the bimanual method about to be described. It also seems likely that the presence of the closed fist above the internal os would tend to displace the presenting part, and it is also more liable to injure the vulnerable lower uterine segment than are the tips of the fingers as used in the bimanual method (Figs. 1071 and 1072).

Bimanual Dilatation.—The method to be now considered will perhaps be better appreciated by a glance at the accompanying illustrations than by any written description. (Figs. 1073 to 1080.) Like all methods of manual dilatation it must be preceded, when necessary, by some degree of dilatation obtained by one of the steel instruments, or by a tampon of gauze packed into the uterus and cervix. This preliminary treatment is, of course, more important during pregnancy than during labor. In all cases care should be taken that the pressure applied in dilatation is applied to the internal os, especially in those cases already mentioned in which this has not been effaced.

FIG. 1079.—BIMANUAL DILATATION OF THE PARTURIENT OS.—(*From a photograph taken at the Emergency Hospital.*)

Indications.—In *placenta prævia* there is usually such slight resistance to be overcome that one may proceed at once to dilate with the fingers. If hemorrhage becomes severe, bipolar version by the Braxton-Hicks method may be done, and while the fetal leg is held by an assistant, hemorrhage being thus controlled, bimanual dilatation may be continued until a sufficient degree of dilatation is reached to permit extraction (Fig. 1080). Here the bimanual method possesses a marked advantage over all others. Indeed, it is the only method which is not rendered impracticable by the pressure in the cervical canal of the fetal thigh or half breech. In *eclampsia* in pregnancy or labor when dilatation and softening have not commenced, preliminary treatment of the cervix will be necessary, and in the mean time such medicinal treatment, in the way of elimination, etc., as may be necessary should be continued. If labor has begun and the cervix is already partially dilated, manual dilatation can be at once instituted. Manual dilatation may also be found useful in cases in which sudden death of the mother renders *post-mortem delivery* necessary, as, for example, in cases of maternal apoplexy or cardiac disease, in intrauterine *asphyxia* of the fetus from any cause, in *faulty presentations and positions*, in *prolapse of the cord*, in *delayed first stage*, cervical rigidity, uterine inertia, etc.

I believe that there is one use of bimanual dilatation which is too often neglected; namely, its employment in the treatment of *delayed first stage* with reference, not to immediate delivery, but to the acceleration of labor. When delayed labor is due to reflex causes,—*i. e.*, fear, excitement, pain, hysteria,

etc.,—a short, deep anesthesia accompanied by partial manual dilatation is often followed by the happiest results. The temporary use of chloroform to the obstetric degree, however, or perhaps, better still, the use of chloral, is usually sufficient in these cases. It is, moreover, useful in cases in which, owing to a *faulty direction of the uterine axis* or some slight departure from the normal mechanism, cervical dilatation does not progress satisfactorily. In these cases a partial manual dilatation is often followed by a rapid and satisfactory completion of labor. When used in this manner, manual dilatation is not to be

FIG. 1080.—BIMANUAL DILATATION OF THE PARTURIENT CERVIX, CARRIED ON AFTER THE BRINGING DOWN OF ONE LEG BY BRAXTON HICKS' METHOD OF BIPOLAR VERSION, FOR PLACENTA PRÆVIA.

regarded as an interference with, but rather as an assistance to, the natural process of labor.

Advantages.—The advantages of the bimanual method I believe to be the following: (1) It is a closer imitation of the natural process of cervical dilatation than are any of the other methods which are available when immediate delivery is necessary. The preliminary dilatation and partial softening of the cervix by the use of the cervical tampon or hydrostatic bag causes an even closer approach to the natural process. (2) The membranes are preserved throughout the operation or until a full dilatation is obtainable. (3) There is no interference with the original presentation and position. (4) The sense of touch of the operator's fingers is unimpaired. (5) There is

no constriction of the operator's hands. (6) The amount of force exerted can be better estimated, and hence there is less likelihood of lacerations. (7) In placenta prævia there is less preliminary separation of the placenta by this method than by any other. (8) There is less danger of sepsis and of injury to the lower uterine segment because of the limited amount of manipulation within the uterus. (9) It can be performed with a presenting part, as the leg, in the os (Fig. 1080).

FIG. 1081.—DANGERS OF A RAPID BREECH EXTRACTION THROUGH AN IMPERFECTLY DILATED OS. The external os not being fully dilated or paralyzed, traction on the legs or breech results in extension of the head and both arms above the cervix.

FIG. 1082.—CERVICAL CANAL OF THE FOURTH MONTH OF PREGNANCY UNCHANGED.

Operation.—The patient is placed in the lithotomy position, the index-finger of one hand is introduced within the cervix, which is drawn upward behind the symphysis. (Figs. 1079 and 1073.) When the dilatation is sufficient to permit the introduction of the tip of the other forefinger, this is introduced opposite its fellow and pressure is made by both fingers in opposite directions (Fig. 1074). A sterile towel drawn tightly accross the perineum and pinned to a sheet covering the abdomen on either side will prevent contact of the unused fingers of the lower hand with the anus. This pressure is continued as a sort of eccentric massage, the fingers of the opposite hands always making gentle and steady pressure outward and downward and in opposite directions. The pressure, at first made antero-posteriorly, is subsequently made laterally and obliquely, the points on which the force is exerted being constantly changed so that all parts of the cervical ring are in turn subjected to it (Fig. 1076). As dilatation progresses

FIG. 1083.—CERVICAL CANAL OF A PRIMIPARA, WITH BEGINNING DILATATION OF THE INTERNAL OS. 1, Internal os; 2, external os.—(*Leopold.*)

the second finger of the right hand is introduced alongside of the first, then the second of the left hand, as shown in the illustrations, and progressive pressure continued as already described (Fig. 1077). After full dilatation is accomplished some time should be spent in producing complete relaxation and paralysis of the resisting cervical ring (Fig. 1078). After this is accomplished, however, extraction should be performed as quickly as possible, since the cervix is likely to recontract.

I desire to protest against the rapid manual dilatation of the os; namely, the complete dilatation performed within an hour, before the action of the uterus has caused the cervix to become relaxed, at least to a certain degree. If the internal ring is present and in a rigid state, as is shown in Fig. 1082, preliminary treatment should be instituted by the use of a cervical dilator of gauze, a hydrostatic bag, or the Bossi dilator, that will induce a certain amount of uterine action with cervical dilatation and softening and cause the rings of the os to

FIG. 1084.—CERVICAL CANAL IN A PRIMIPARA WITH BEGINNING DILATATION OF THE INTERNAL OS. ECLAMPSIA.—(*Leopold.*)

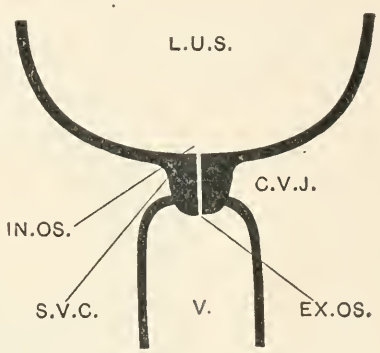


FIG. 1085.—CERVIX IN LATTER PART OF GESTATION OR AT BEGINNING OF LABOR. VAGINAL AND SUPRAVAGINAL PORTIONS OF CERVIX UNCHANGED. *v.*, Cuff of vagina; *ex.os.*, external os and infravaginal portion of cervix; *c.v.j.*, cervicovaginal junction; *s.v.c.*, supravaginal portion of cervix; *in.os.*, internal os; *l.u.s.*, lower uterine segment.

become sufficiently relaxed so that rapid dilatation is rendered a safe operation. Rapid manual dilatation may be undertaken and complete paralysis of the cervix attained within an hour, as shown in Fig. 1078, even when there is a minimum amount of uterine action or when the os is in a softened, yielding, and relaxing condition, although the anatomical conditions pictured by Fig. 1084 may exist. A strictly expectant treatment in respect to emptying the uterus is far preferable to the attempt quickly to overcome a rigid os by manual means, when the supravaginal portion of the cervix still persists (Figs. 1082 1085). To the writer's knowledge such a procedure has ended in complete rupture of the uterus followed by a prolapse of the maternal intestines between the operator's fingers in more than one instance.

IV. INSTRUMENTAL DILATATION OF THE CERVIX.

Indications.—Dilatation of the os is a part of the induction of abortion and premature labor (see page 888). As a general rule, it may be said that the physician should be slow to resort to manual or instrumental dilatation simply for tedious labor, especially with unruptured membranes. Having satisfied himself that the delay is not due to malposition or malpresentation, and the condition of mother and child does not require immediate interference, better results will usually be obtained by the use of chloral or a light temporary anesthesia, and by an effort to discover and remove the cause of the delay (see Anesthesia, page 865, and Delayed Labor, page 568), and thus the mother will be saved the dangers of shock and sepsis which to a greater or less extent

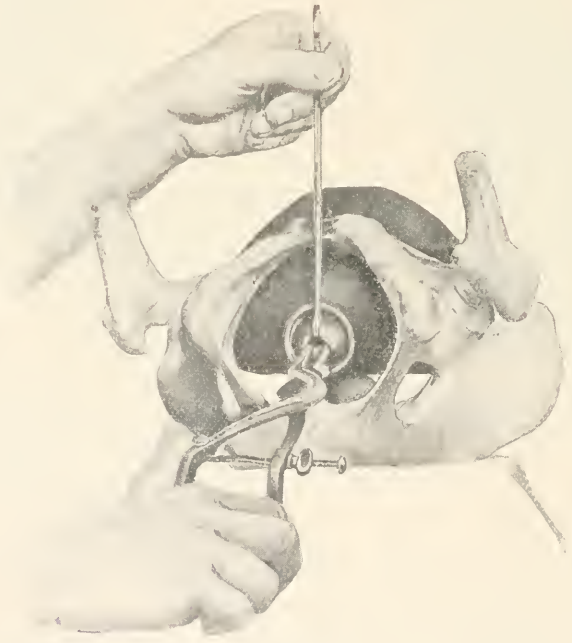


FIG. 1086.—INSTRUMENTAL DILATATION OF THE PARTURIENT OS PREPARATORY TO FURTHER MANUAL DILATATION, GAUZE PACKING, THE INTRODUCTION OF BOUGIES FOR THE INDUCTION OF LABOR, OR CERVICAL DILATORS.—(*From a photograph of the author's model.*)

attend even a carefully conducted operation. The instruments ordinarily used for producing dilatation of the cervix are gauze or metal or vulcanite dilators, bags of rubber or silk dilated with water, and the hand.

Uterine and Cervical Tampon.—A valuable method, although a slow one, of securing cervical dilatation at any time in pregnancy is to pack the lower uterine segment and cervical canal with iodoform or sterile gauze until moderate pressure is attained. The packing cannula (Fig. 1069) is most convenient for this operation. The vagina is subsequently packed and a T-bandage applied and the gauze left in for from six to twelve hours. This method I find invaluable as a preliminary to rapid manual dilatation of the os (see page 902), in cases of eclampsia, placenta prævia, and accidental hemorrhage, as a preparatory measure to cause the disappearance of the supravaginal portion of the cervix

(internal os), and to soften the cervix and the whole lower uterine segment so that the subsequent rapid dilatation can be easily and safely accomplished.

Graduated Hard Dilators.—These are made of steel or vulcanite and are used in somewhat the same manner as uterine sounds; the smallest being first passed into the cervix and then the larger sizes successively until the dilatation is deemed sufficient. There are several varieties: Hanks', Hegar's, Peaslee's, Kammerer's, etc. Male sounds, Nos. 15 to 18 French, may often be used with satisfaction. *Method and Operation:* The patient is in the lithotomy position, the perineum is retracted by a speculum. The anterior and posterior lips of the cervix are drawn down by volsellum forceps. A sound shows the depth and direction of the cervical canal. The smallest sound is then introduced and the dilatation carried as far as necessary by the successive introduction of the larger ones.

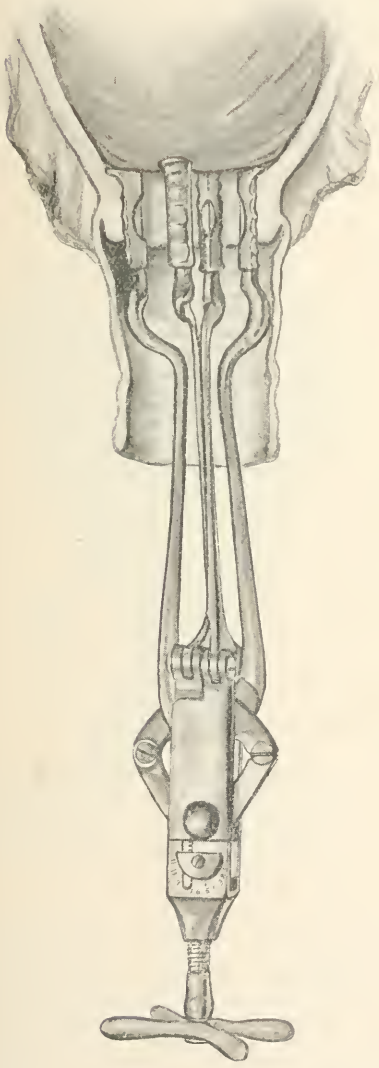


FIG. 1087.—BOSSI'S DILATOR FOR THE PARTURIENT CERVIX.

FIG. 1088.—GAU'S DILATOR FOR THE PARTURIENT CERVIX.

Branched Steel Dilators (Fig. 1086).—This kind of dilatation, so useful in gynecological practice, has hitherto played but a minor rôle in the department of obstetrics. The branched steel dilators heretofore in use have been of service only in cases in which a tightly closed external os rendered their use necessary as a preliminary to other methods of dilatation. Dilatation is effected by passing

the closed instrument into the cervix and separating the branches by compression of the handles, applied either directly by the hands or through the medium of a screw. Sims' and Ellinger's may be regarded as types. There have been various modifications. Recent work on the use of large obstetric steel dilators, however, has opened up new possibilities in this direction. One of the more recent steel obstetric dilators is the four-bladed one of Bossi (Fig. 1087). It is probably the best instrument now at our disposal. Steel instruments are, of course, more easily rendered aseptic than is the hand. It is difficult, however, to estimate the amount of force used, nor is a steel instrument so perfectly under the operator's control. It is safe to say that, as an imitation of the natural process, and therefore as a safe method of dilatation, no steel instrument at present devised can be used which will entirely take the place

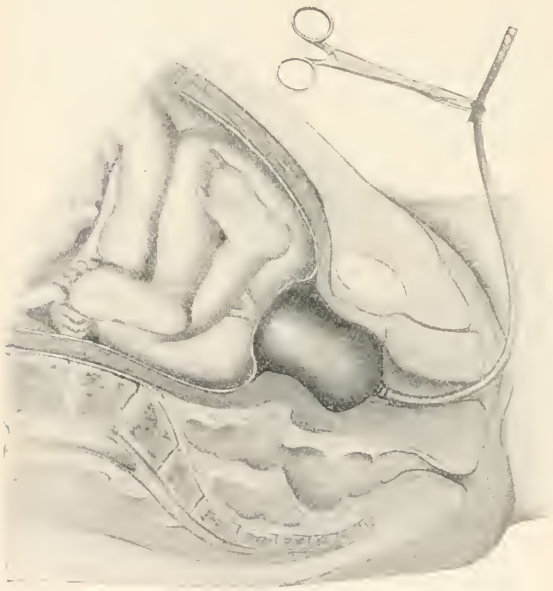


FIG. 1089.—BARNES' RUBBER HYDROSTATIC DILATOR IN POSITION IN THE CERVIX.

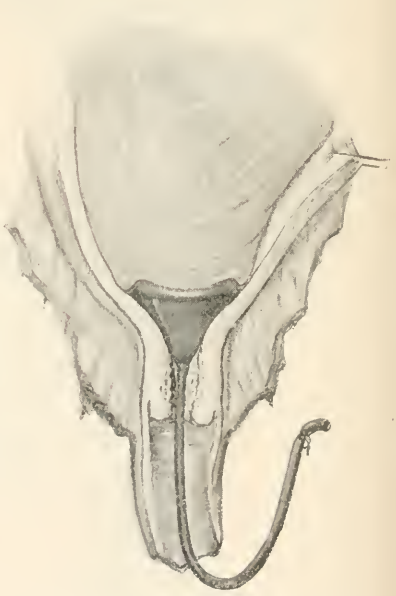


FIG. 1090.—THE MODIFIED CHAMPETIER DE RIBES' HYDROSTATIC CERVICAL DILATOR IN POSITION IN THE LOWER UTERINE SEGMENT.

of the dilating bags in cases which permit slow dilatation, or of the bimanual method in cases of great emergency. *Method of Operation:* The position of the patient and the preliminary manipulations are the same. The closed branches of the dilator are passed as far as the shoulders. The blades are separated laterally, then the instrument is rotated and they are separated antero-posteriorly. Dilatation should be very slow and gradual. Force is used to cause the cervix to yield, not to tear; and the less force which will accomplish the purpose, the better.

Hydrostatic Dilators.—These are of rubber or silk, are hollow, and are distended after their introduction by means of water which is forced into them with a Davidson or piston syringe. Barnes' hydrostatic dilators have been entirely supplanted by the Champetier de Ribes' bag and its modifications. The bag of Champetier de Ribes (Fig. 1090) is made of rubber but has a silk

lining to prevent bursting. It is in the shape of a cone, the larger end being introduced first. When distended with water, nature's method of dilatation is somewhat closely imitated. This is especially true of the bag of Champetier de Ribes and its modifications, and the colpeurynter of Dührssen. These well-known instruments, which have the shape of a funnel or an inverted cone, may be drawn into the cervical canal and against the internal os in a manner closely simulating the method of nature. I regard the de Ribes bag or its modifications as valuable for the following reasons: (1) The natural process is more closely imitated, the cervix being dilated from within outward according to

FIG. 1091.—METHOD OF GRASPING THE MODIFIED DE RIBES BAG FOR INTRODUCTION INTO THE CERVIX.

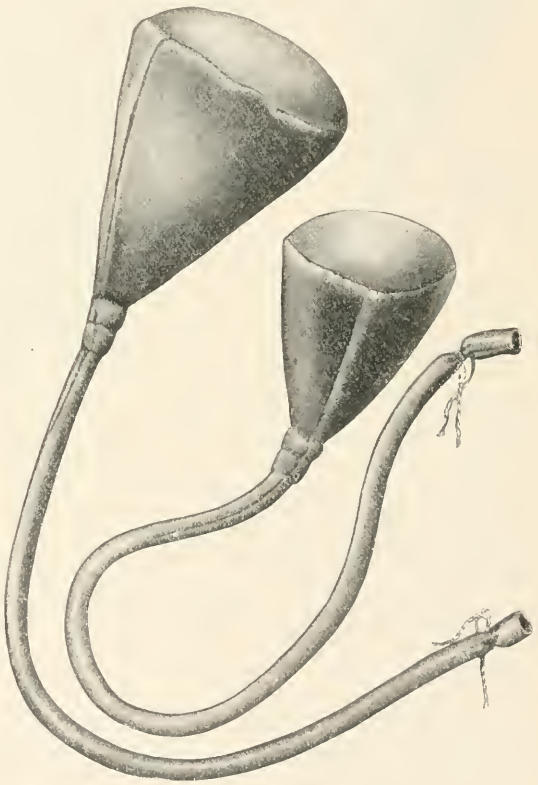


FIG. 1092.—MODIFICATION OF CHAMPETIER DE RIBES' HYDROSTATIC CERVICAL DILATORS. TWO SIZES SHOWN.

the natural process. (2) The bag does not slip out. (3) By gentle traction upon the tube one can cause uterine contraction and assist in dilatation if necessary. (4) The bag is not likely to burst. (5) It is a valuable agent in prolapse of the funis or fetal small parts, in premature rupture of the membranes, in placenta prævia and other complications.

Method of Introducing the Soft Dilators:—A certain amount of dilatation is presupposed. The dilator should be folded upon itself, lubricated with a 1 per cent. lysol solution, seized with a pair of long dressing forceps, and passed

within the cervix until the constricted part, if a Barnes bag is used, is at the internal os, or until half the bag, if a de Ribes bag is used, is within the internal os (Fig. 1091). The Barnes bag is provided with a pocket into which a sound may be inserted and the bag passed into the cervix with the sound. The first method, however, is more satisfactory. Bags should not be distended with air, since their rupture may then be attended with serious consequences. Water should be used and should, of course, be forced in slowly and gradually. In using the Barnes bag, when the smaller-sized bag has been expelled, the next larger one should be inserted if necessary. With the de Ribes bag no change is necessary unless one uses graduated sizes, which may now be obtained of the instrument-makers in New York. In every instance when a hydrostatic cervical dilator is used, the bag should be carefully tested before introduction. This is done by forcing a given number of bulbfuls of water from a Davidson syringe into the bag so as fully to distend it; then, if the bag remains intact, it is introduced and to insure against rupture one bulb less of water is pumped in than in the test examination. I have in two instances seen rupture of the uterus, as proved by autopsy, caused by the intrauterine explosion of an overdistended Barnes bag. The large Champetier de Ribes dilators, as originally sold, should be avoided, and only the smaller ones used. The former occupy too much space in the lower uterine segment, change its shape, and favor malpresentation of the fetus. In my practice I observed a vertex presentation changed thus to a shoulder, for which I was compelled to perform an internal podalic version.

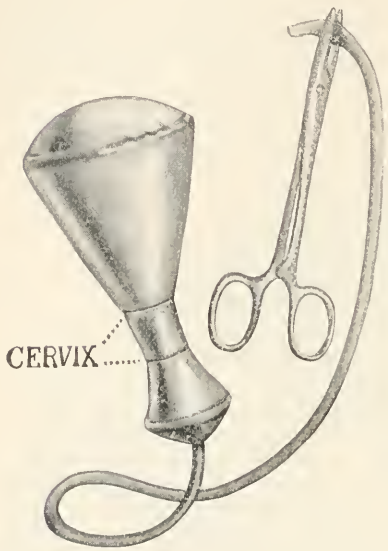


Fig. 1093.—Coe's Modification of Champetier de Ribes' Hydrostatic Cervical Dilator.

V. MANUAL AND INSTRUMENTAL DILATATION OF THE VAGINA AND VULVA.

Indications.—Occasionally in very old or very young primiparæ, in cases of cicatrices from previous inflammation and ulceration, in malignant disease and thrombosis, artificial dilatation of the vagina may be demanded. I have occasionally been compelled to employ this operation in elderly primiparæ and in the very young. In cicatricial stenosis of the vagina, dilatation by the fingers or hydrostatic dilators may occasionally be required, but in most cases the natural forces will overcome the obstruction, even when the original opening would admit but one finger. In cases in which the vagina is simply small and rigid—*e. g.*, in very young or in old primiparæ—the resistance is chiefly at the lower third, and the case should be left to nature as long as is judged safe. A carefully conducted forceps operation with very slow extraction is then to be considered as the best means of effecting further dilatation. If even this bids fair to produce severe laceration, or if rapid delivery is imperative, episi-

otomy (*q. v.*) may be required. In certain cases of a small and rigid vulva and lower third of the vagina surprisingly good results may be obtained by manual

FIG. 1094.—DIGITAL DILATATION OF THE VULVA IN A PRIMIPARA.

dilatation, one or two fingers being introduced into the posterior commissure followed by intermittent backward massage-like pressure (Fig. 1094).

VI. INCISIONS OF THE CERVIX, VAGINA, AND VULVA.

1. Superficial, and 2. Deep Incisions of the Cervix.—(1) *Superficial multiple incisions:* These as well as deep incisions are required only in exceptional cases, and are especially liable to extend and involve the branches of the uterine artery. Superficial incisions or nicks in the cervix are indicated only when the use of chloral or some other anesthetic has failed, and when manual dilatation without the use of a dangerous degree of force does not succeed. This most often occurs in rigidity of the portio vaginalis in old primiparæ, and in multiparæ when several years have elapsed since the birth of the last child. There is a lack of elastic tissue, or atrophy of the elastic fibers has already begun. It may also be indicated in cases of atresia in which the os cannot be opened by the finger or dilator. In this case, if the os cannot be located, the stretched cervix may be raised by tenacula at its thinnest point, and a crucial incision made. The superficial incisions are made by a blunt-pointed bistoury or a pair of blunt-pointed scissors. During a pain, the patient being in the lithotomy position, the instrument is carried into the vagina under the guidance of the fingers, and the stretched cervical rim is incised in several places to the depth of 0.5 cm. (Fig. 1095). Dilatation sometimes occurs with surprising rapidity after this procedure. Care should be taken that such

incisions are really superficial, since when carried further they are likely to extend and to result in disastrous lacerations of the lower uterine segment. (2) *Deep incisions:* Incisions of the cervix extending to the utero-vaginal junction and involving the entire vaginal portion were first proposed by Skutsch and first performed by Dührssen. *Indications:* Those usually given are: any emergency which requires immediate delivery in the presence of an undilated

FIG. 1095.—MULTIPLE SUPERFICIAL INCISIONS OF THE EXTERNAL OS.

FIG. 1096.—DEEP INCISIONS OF THE PARTURIENT CERVIX, EXTENDING FROM THE BORDER OF THE EXTERNAL OS TO THE UTERO-VAGINAL JUNCTION.

and rigid cervix; *e. g.*, eclampsia, accidental hemorrhage. The operation should not be performed until the supravaginal portion of the cervix has disappeared,—in other words, when the defective dilatation is confined to the vaginal portion of the cervix,—and is, therefore, much more frequently indicated in primiparæ. In multiparæ mechanical dilatation is usually sufficient. In the presence of

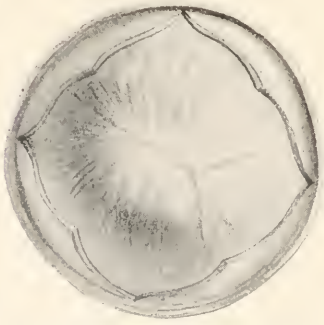


FIG. 1097.—EFFECT OF THE FOUR DEEP INCISIONS OF THE CERVIX UPON DILATATION.

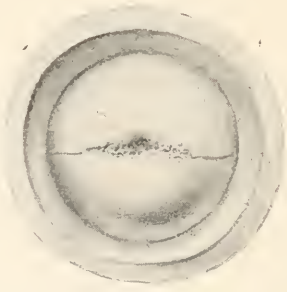


FIG. 1098.—AUTHOR'S CASE OF DEEP BILATERAL INCISIONS OF THE CERVIX THIRTEEN MONTHS AFTER DELIVERY. PARTIAL REPAIR HAS TAKEN PLACE IN THE BILATERAL INCISIONS.

immediate danger, however, the supravaginal portion still being present, the two procedures may be combined with advantage; that is, mechanical dilatation until the internal os has been obliterated and rapid completion of the dilatation by deep incisions. There is one condition in which they should always be

avoided; namely, in arrest of the after-coming head during breech delivery, or after version in multiparæ. Here the resistance is at the internal os, and any but the most superficial incisions would be likely to result in extension to uterine rupture during the process of delivery. *Operation:* The patient being in the lithotomy position, the free edge of the os is fixed between two bullet forceps, and under the guidance of the index and middle fingers of the left hand, one within and the other without the cervix, the vaginal portion of the cervix is incised by a pair of long, blunt-pointed, straight or angular scissors or a bistoury, care being taken that the incision is brought fully up to the utero-vaginal junction. If the incision stops short of this point, full dilatation does not take place and extension beyond the vaginal attachment may occur from tearing. Care should be taken that a fold of vagina is not included in the incision, since this, in case of the posterior incision, might open into the pouch of Douglas, or in case of the anterior incision might involve the utero-vesical pouch or even the bladder.

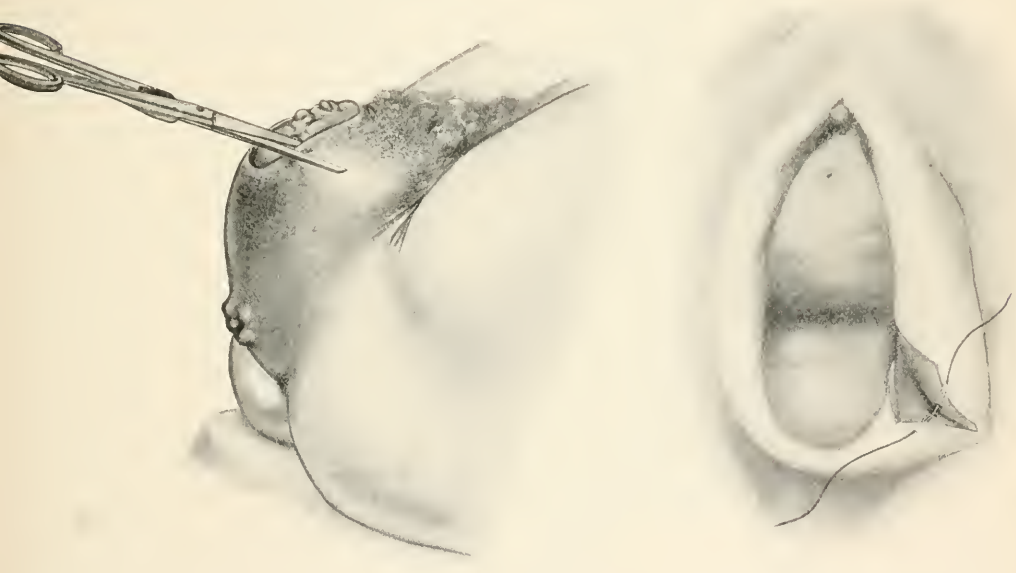


FIG. 1099.—EPISIOTOMY.—(*The face presentation is from a photograph of the author's case taken at the Emergency Hospital.*)

The same mistake in the case of a lateral incision might result in severing a ureter. Four incisions are usually made, two antero-posterior and two lateral (Figs. 1096 and 1097). Suture is not necessary except in case of severe hemorrhage, which should not occur if the incisions have been properly made. Spontaneous union of the edges usually occurs. The risks of septic infection are the same as in any other internal obstetric procedure. The field of this operation is most limited. The operation itself is a serious one and not lightly to be undertaken. In all but exceptional cases rapid bimanual dilatation of the os, or rapid bimanual dilatation of the os combined with these incisons, will fulfil all indications.

Incisions of the Vagina.—These are most often called for in cases of cicatricial contraction or congenital defects, and are best made along the lateral vaginal wall

with a blunt bistoury. A comparatively large number of shallow incisions are to be preferred to a few deep ones, since there is less danger of hemorrhage. Lateral incisions are to be preferred to anterior or posterior ones, when possible, since the latter may involve important structures—bladder, peritoneum, rectum. In all cases, however, labor may usually be terminated either spontaneously or by the use of forceps or version, with manual dilatation of the vagina without using the knife. Cases of unyielding circular cicatricial contraction may be treated by a cruciform incision.

Incision of the Vulva. Episiotomy.—*Definition:* The operation of making lateral incisions in the vulva in order to avoid laceration of the perineum. *Indications:* It is indicated when delivery without severe perineal laceration is deemed impossible—usually in cases of great disproportion in size between the fetal head and vulval outlet. It is seldom necessary, however, and in the absence of cicatricial contraction better results will usually be obtained by awaiting the natural process of dilatation. *Operation:* The operator should remember that it is not the border of the vulva which resists the progress of the head, but the tense ring situated about half an inch above. During a pain this ring is readily recognized about half an inch above the muco-cutaneous junction. The incisions should not be in the line of the vulvo-vaginal outlet as it appears during the stage of expulsion, or it will be found after delivery that they have been directed too far backward. They should be made in a direction corresponding to the long axis of the mother's body as she lies in the recumbent position. Under the guidance of the fingers a blunt-pointed bistoury is passed flatwise against the resisting ring, then turned, and the ring incised from within outward. The incision should not exceed an inch in length and its depth should be about a quarter of an inch. It should be made at a point about one-third of the distance from the posterior to the anterior commissure when the parts are on the stretch. In this location the only parts severed are the skin, fascia, and perhaps the bulbo-cavernosus muscle (Fig. 1099). If preferred, the incision may be made with blunt-pointed scissors (Fig. 1099). Care should be taken that the head is not suddenly forced out during the operation. For this reason it is better that the incisions should be made at the beginning or toward the end of a pain, and that the progress of the head be retarded if necessary. After delivery the incisions are at once closed by suture. In suturing it is convenient that the mother lie upon the right side while the left incision is being sutured, and vice versa. In this way the field of operation is kept clear of blood.

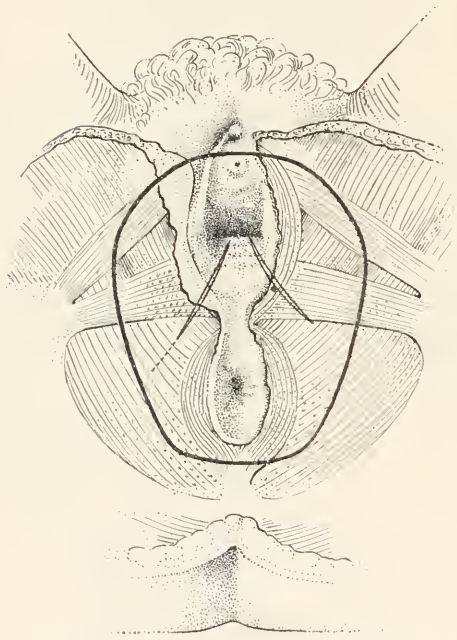


FIG. 1100.—DEEP VAGINO-PERINEAL INCISIONS FOR SMALL AND RIGID VAGINÆ.—(*Dührssen.*)

Vagino-perineal Incision.—Dührssen advises in some cases of small and

rigid vaginæ in which immediate delivery is urgent, incisions which divide not only the constrictor cunni but the levator ani. These he calls vagino-perineal incisions. He advises that when possible only one incision be made. This method has thus far not met with general approval (Fig. 1100).

VII. CORRECTION OF FAULTY POSTURE, MALPOSITIONS, AND MALPRESENTATIONS.

1. Manual Correction of Bregma, Brow, and Face Presentations.—(1) SCHATZ EXTERNAL METHOD: This method is limited to those cases in which the head

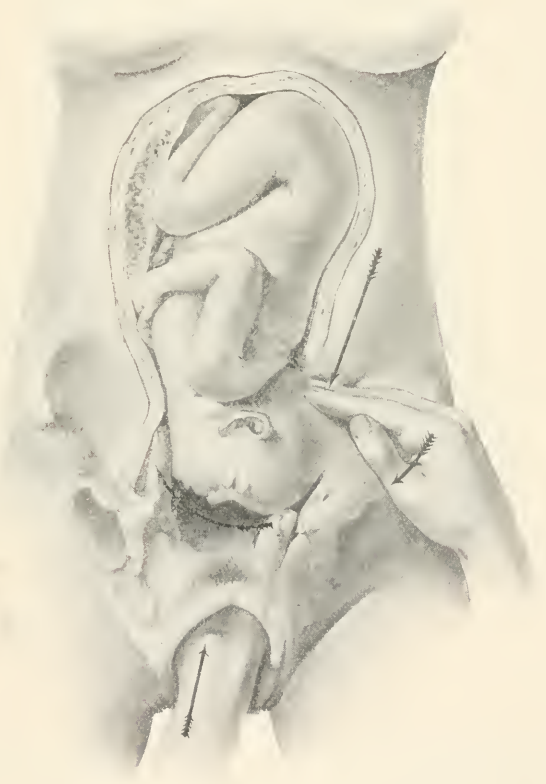


FIG. 1101.—MANUAL CORRECTION OF BROW AND FACE PRESENTATION. Rotation of the head upon a transverse diameter to produce flexion with the internal hand, and downward pressure upon the occiput with the external hand. (Baudelocque's method.)

is not engaged and is freely movable; the membranes are unruptured, or if ruptured the fetus is readily moved about in the uterus; and there is no immediate demand for the rapid termination of labor. The method is only exceptionally successful, there having been many failures, and by reason of the conditions necessary for its performance, has a very limited field, being confined mainly

* Thorn: "Zeit. für Gynecol. v. Geburts.," XIII, 186.

to maternity hospitals, where the anomalies are recognized early in labor. Although Schatz describes his method as applicable to face presentations, from a mechanical standpoint it is also applicable in bregma or brow presentations. *Operation:* Anesthesia is not always required. The patient is placed in the dorsal posture with knees partly drawn up; the operator stands on the side toward which the occiput is directed. Between uterine contractions one hand grasps the breech and one the anterior shoulder, and an even, strong pressure is made upon the shoulder toward the occiput and somewhat upward; the breech is at the same time pushed upward with the other hand and also toward

FIG. 1102.—MANUAL CORRECTION OF FACE, BROW, AND BREGMA PRESENTATION. The internal hand rotates the head upon a transverse diameter by drawing down the occiput, and the external hand pushes the anterior shoulder to the side toward which the dorsal plane lies. Thorn's method.*

the abdominal surface of the fetus; finally, the breech is pressed downward. During the uterine contractions all manipulations cease and the head is grasped through the abdominal walls and fixed. After the occiput is brought over or into the pelvic inlet, the membranes may be ruptured and the head held until engagement occurs (Fig. 684). (2) COMBINED EXTERNAL AND INTERNAL METHOD: If the above method fails, which is pretty sure to be the case, one of the following can be tried. (*a*) *Digital pressure:* In bregma and brow, and occasionally in face presentations, passing two or three fingers into the vagina and pressing up upon the bregma, brow, and at the same time using counter-pressure with

the whole of the remaining hand upon the breech of the fetus, will often rotate the fetal head upon its transverse axis (Fig. 1103). In this method the dorsal posture with flexed thighs is used for the patient, and the operator stands or, better, sits on the side of the patient toward which the occiput points. (*b*) *Lifting of the brow and face:* With the same positions of patient and operator, but under anesthesia, the hand, the palm of which corresponds with the fetal face, is passed into the vagina and grasps the forehead or face and carries it away from the pelvic inlet in the direction of the fetal chest, while the external

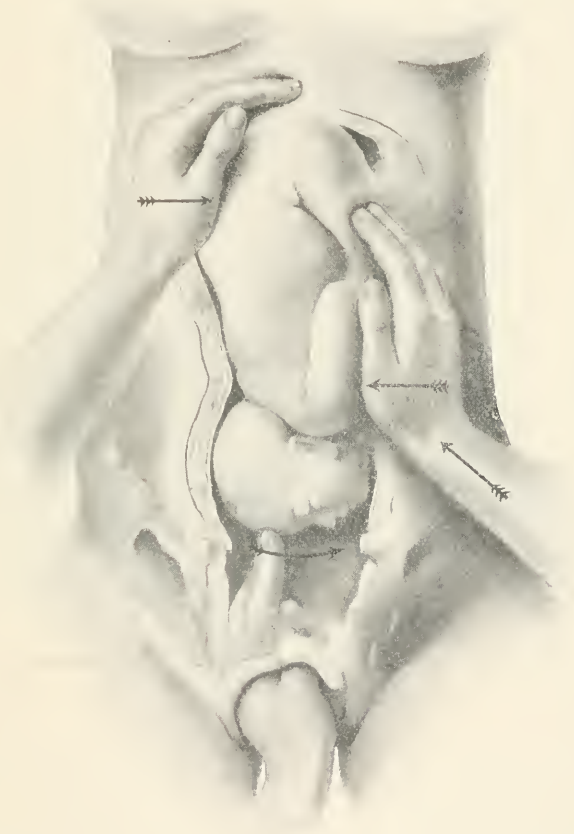


FIG. 1103.—COMBINED MANUAL METHOD FOR THE CORRECTION OF FACE AND BROW PRESENTATIONS. SCHATZ-THORN METHOD.

hand presses the occiput down, through the abdominal walls, into the pelvic inlet (Fig. 1101). Before the internal hand is removed the operator must satisfy himself that the large fontanelle is actually higher than the small one, and that the vertex is about to engage. In difficult cases the Trendelenburg posture will be of great assistance. Humphrey used the knee-elbow posture for the patient. (*c*) *Drawing down the occiput* (*Thorn's method*): The posture of the patient is the same as above, but the operator sits or stands on the side toward which the fetal abdomen points. The hand, whose palm would naturally grasp the occiput, is passed into the vagina, and draws down the occiput with

an even traction, while at the same time the external hand pushes the chest of the fetus, or rather the shoulder, to the side toward which the dorsal plane lies (Fig. 1102). The Trendelenburg posture will greatly aid this manipulation. (*d*) *Combined methods:* In very difficult cases a combination of Schatz's and

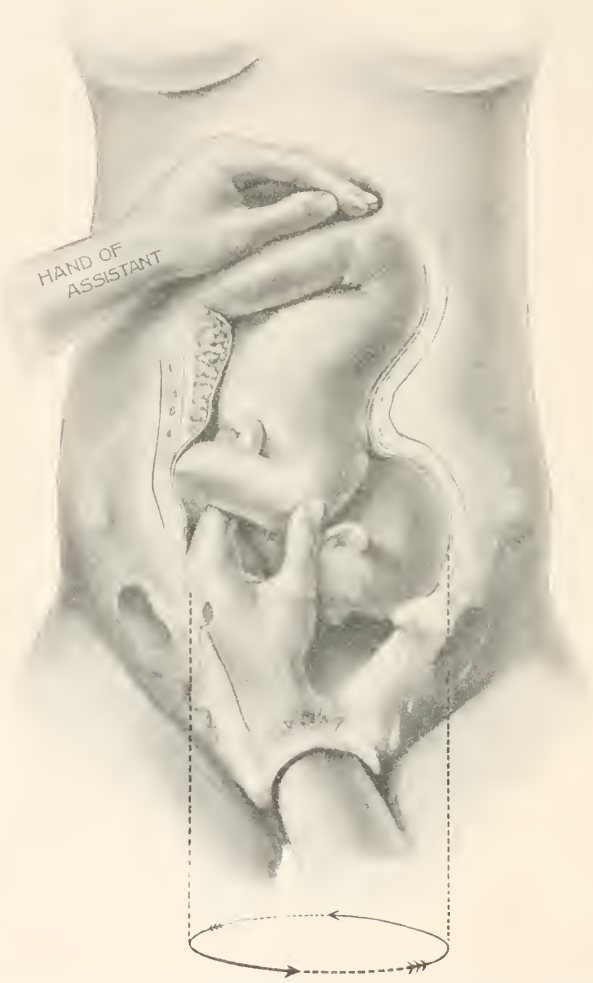


FIG. 1104.—MANUAL CORRECTION OF A PERSISTENT MENTO-POSTERIOR POSITION BY MANUAL ANTERIOR ROTATION OF THE FETAL CHEST AND CHIN.

the method of drawing down the occiput by internal manipulation has been successful (Fig. 1103).

2. **Persistent Occipito-posterior Position.**—(See Pathology of Labor, page 547.)

4. **Persistent Mento-posterior Position.**—(See Pathology of Labor, page 550.) (Fig. 1104.)

4. **Reposition of Prolapsed Cord.**—(See Pathology of Labor, page 525.)

5. **Reposition of Prolapsed Arms and Legs.**—(See Pathology of Labor, pages 520 and 522.)

VIII. THE VECTIS.

The vectis was one of the simplest forms of instruments used for extracting or changing the position of the fetal head; it antedated the forceps, and has practically been abandoned as an instrument by itself, in favor of the forceps, which has proved both safer and more effective. The principle of the vectis is still used in obstetrics, however, by utilizing one blade of the forceps, and from time to time attempts have been made to revive interest in the value of the original instrument.* It resembles a single blade of a pair of straight forceps except that the cephalic curve is much more pronounced, especially near the extremity of the instrument, in order to permit of a better hold of the head (Fig. 1105).

FIG. 1105.—THE COPEMAN VECTIS.

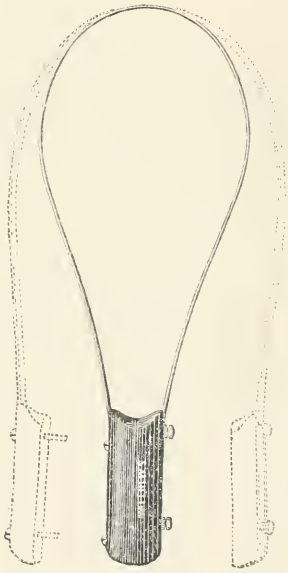


FIG. 1106.—THE FILLET.—(*Galabin.*)

The vectis was used as a lever and a tractor, and some of the English writers† still recommend its use in persistent occipito-posterior positions and brow presentations. In the former case it was used as a combined lever and tractor to favor anterior rotation, and in the latter as a tractor to convert the brow into a vertex or face. I believe the forceps to be a safer and more efficient instrument for the first purpose, and the hand of the obstetrician for the second.

IX. THE FILLET.

The whalebone fillet, consisting of an inverted U-shaped piece of whalebone joined at the extremities of the U by a handle, is an instrument intended to rotate the head upon its transverse axis, thus producing either flexion or extension, as desired, by traction upon one pole of the head (Fig. 1106). The instru-

*Bartlett, John: "The Vectis," "The Clinical Review," Chicago, Nov., 1900.

†Galabin: "A Manual of Midwifery," London, 1900, p. 612.

ment antedates the forceps, and is now, perhaps with less justice than the vectis, considered obsolete. Placed over the chin to produce extension of the head by traction on the handles, the instrument was liable to injure the fetus, and its hold on the occiput to increase flexion of the head was always uncertain and dangerous by reason of the tendency of the fillet to slip. As in the case of the vectis, the hand of the obstetrician passed into the vagina combined with bimanual manipulation will do all and more than the fillet. (See page 911.) The contingency might possibly arise when in the absence of instruments an improvised fillet of whalebone or wire could be used to flex the extended head of a dead fetus, and possibly of one living.

X. REPOSITION OF SMALL PARTS.

1. **Umbilical Cord.**—(See page 525.) (Also Figs. 1107 to 1113.)

2. **Other Small Parts.**—If in the course of labor in cranial presentations with unruptured membranes, some small part—the hand, for example—prolapses, it will almost always be found at the facial side of the head. Reposition can usually be effected by placing the woman on the side opposite that of the

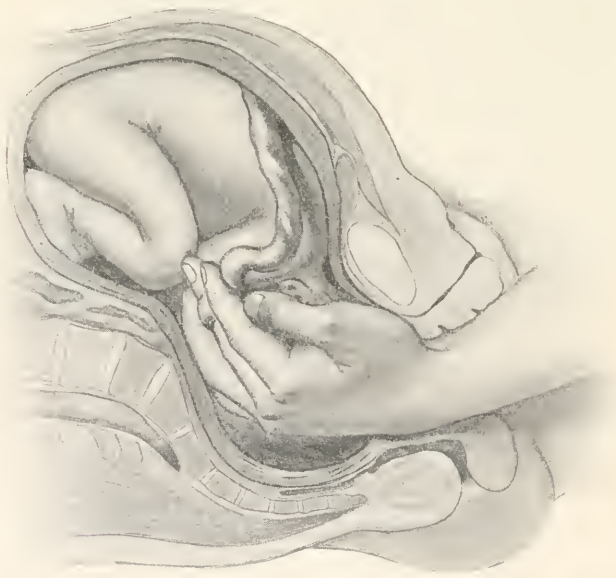


Fig. 1107.—Manual Reposition of a Prolapsed Cord.

prolapse, and when the head is allowed to re-engage the obstacle will be out of the way. (1) In case the membranes have ruptured and a hand or arm has prolapsed, reposition may often be effected by a simple manipulation, if the os is fully dilated and the head high up. The woman is placed in the latero-prone position (Fig. 1051) and the operator introduces his hand into the vagina and endeavors to conduct the prolapsed part up along the face. The woman should lie on the side opposite the prolapse until the head engages. If this manœuver fails, the operator may sometimes leave the case to nature. In a roomy pelvis

it is quite possible for the head and an arm to engage at the same time. But if the pelvis is contracted or if an indication arises to terminate labor at once, podalic version may be attempted if the head is movable, but otherwise, forceps delivery. In prolapse of a foot in head presentations, which is very rare, the indications are similar. (2) Should the head be well down in the true pelvis, an expectant treatment should be followed; and if any immediate danger threatens, such as delayed labor from obstruction or œdema of the leg, extraction of the head with the forceps should be done, taking care not to include the pro-

FIG. 1108.—INSTRUMENTAL REPOSITION OF A PROLAPSED CORD, ASSISTED BY THE KNEE-CHEST POSTURE OF THE PATIENT.

lapsed leg. Impaction in the case of a dead fetus of course calls for perforation. (3) When the head is movable at the pelvic inlet or extra-medial by reason of the prolapsed leg filling in one side of the pelvis, and the leg constitutes an actual obstruction, manual reposition should be performed. In any event, the existence of twins must be borne in mind, as one may present by the head and the other by the leg or foot. The patient is placed in the lithotomy position or, better, on her side (compare prolapse of cord and arm), and the foot or knee is seized with the whole hand and pushed upward past the head; at the same time a hand on the fundus presses the head into the pelvic inlet from

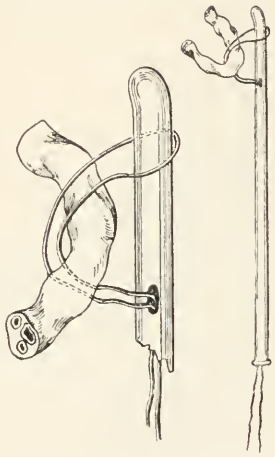


FIG. 1109.—ENGLISH CATHETER AND SLING FOR REPOSITION OF PROLAPSED CORD.

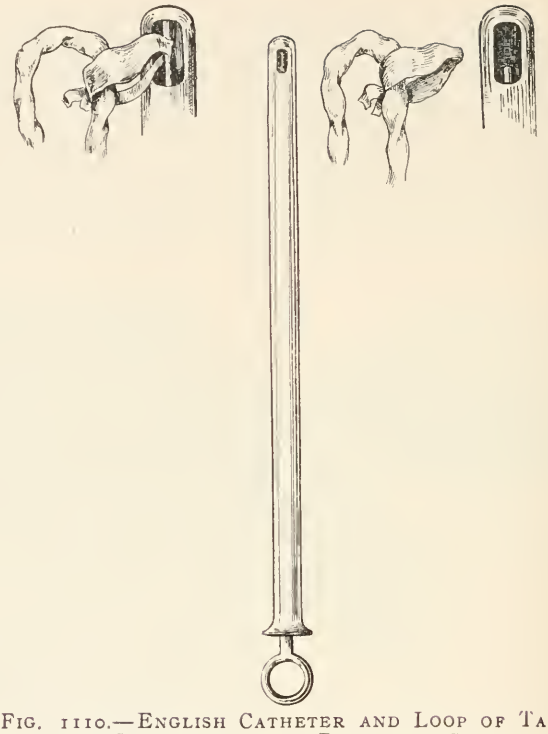


FIG. 1110.—ENGLISH CATHETER AND LOOP OF TAPE FOR REPOSITION OF A PROLAPSED CORD.

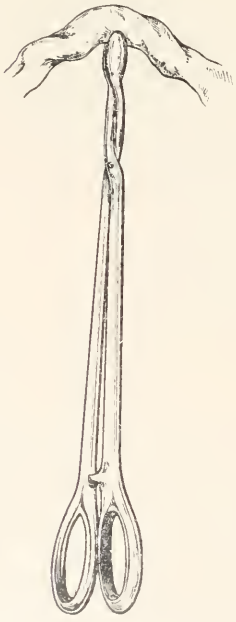


FIG. 1111.—SIMPLE LONG FORCEPS USED TO REPLACE A PROLAPSED CORD.

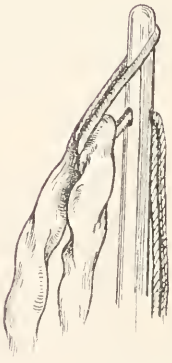


FIG. 1112.—WHALEBONE OR METAL REPOSITOR AND SLING.

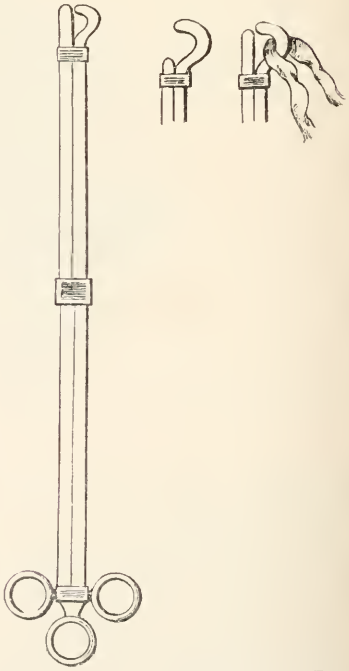


FIG. 1113.—WHALEBONE REPOSITOR FOR A PROLAPSED CORD.

without. Anesthesia is necessary, and in some difficult cases the exaggerated semi-prone, Trendelenburg, or knee-chest position will be required. After reposition the dorsal position will give as satisfactory results as either of the lateral, provided the head is kept applied to the pelvic inlet by pressure on the fundus until engagement takes place. (4) In case manual reposition fails the head may be pushed up and version and extraction promptly performed, the possibility of the existence of twins, and of the presentation of one by the head and of the other by the leg, being always remembered.

XI. VERSION.

Definition.—By version is meant the changing of the presentation of the fetus so that one or the other of the two poles of the fetal ellipse is substituted for a given presentation.

History.—Version is one of the most ancient of the obstetric operations, and before the invention and introduction of the forceps was used much more frequently than it is at present. Cephalic version was the first variety used, and is said to have been recommended by Hippocrates and employed even in pelvic presentations. Before the sixteenth century it was practically the only version used, but at that time podalic version was introduced, and because of the ease of its performance became very popular, and on this account cephalic version was almost entirely abandoned, although more recently revived by some obstetricians.

Classification.—Version is usually classified, first, according to the part of the fetus which is caused to present at the pelvic inlet, into cephalic version, podalic version, and pelvic version. The last of these, namely, pelvic version, is to-day rarely, if ever, performed. Version is again subdivided, according to the mode in which it is performed, into three varieties—namely, external version, combined external and internal or bipolar version, and internal version. External version is performed by external manipulation only; combined external and internal or bipolar version by the use of one hand introduced into the vagina and one or more fingers into the uterus to move one part of the fetus, while the other hand upon the anterior abdominal wall moves another portion of the fetus, thus assisting the internal fingers. Internal version is accomplished by passing the whole hand into the uterus to grasp some part of the fetus, usually the feet, and the other hand is used on the abdomen to steady the fetus and assist the internal hand as far as possible. (See table on page 920.)

Frequency.—In 2200 confinements in New York hospitals I found that version was performed in 44 instances, or 2 per cent., or once in 50 labors.

Indications.—In the 44 versions referred to, the indications were: deformed pelvis in 11 cases; shoulder presentation in 7; shoulder presentation and prolapsed cord in 3; persistent occipito-posterior position in 2; placenta prævia in 6; prolapsed cord in 3; prolapsed cord and hand in 1; prolapsed hand in 1; deformed pelvis and albuminuria in 1; deformed pelvis and shoulder presentation in 2; uterine inertia in 2; prolapse of leg in vertex presentation in 1; brow presentation in 1; hydrocephalus in 1; albuminuria in 1.

Varieties.—Of the 44 cases analyzed, 35 were of the internal podalic variety; 3 bipolar; 6 not recorded.

CLASSIFICATION OF VERSION.

Parts Caused to Present.	Mode of Performance.	Employed.
(A) Cephalic Version	1. External Cephalic.	Occasionally.
	2. Combined External and Internal Cephalic (Bipolar).	Occasionally.
	3. Internal Cephalic.	Rarely.
(B) Podalic Version.	1. External Podalic.	Rarely.
	2. Combined External and Internal Podalic (Bipolar).	Frequently.
	3. Internal Podalic.	Most frequently.
(C) Pelvic Version	1. External Pelvic.	Rarely.
	2. Combined External and Internal Pelvic (Bipolar).	Rarely.
	3. Internal Pelvic.	Obsolete.

Introduction of the Hand in Version.—The hand and forearm, being thoroughly aseptic, are enclosed in a rubber glove and well lubricated with 1 per cent. lysol or creolin solution. The fingers of the hand to be introduced are then brought together in the form of a cone, and the labia separated by the thumb and first and second fingers of the disengaged hand (Fig. 1114). (Compare vaginal examinations, page 153.) The apex of the cone-shaped hand is then pushed into the ostium vaginæ, and entrance is effected by pressing steadily inward and backward upon the distensible perineum. No sudden movements or haste should be used, and ordinary rotation and boring-like movements of the hand are unnecessary and increase the tendency to laceration. Patience and lack of haste are important factors for success and avoidance of lacerations, especially in primiparous patients. After the hand is well in the vagina the cervix is sought, and in combined or bipolar version one, two, or three fingers are carefully inserted through the os according to circumstances. In internal version the hand is passed through the os in practically the same manner as through the vulval orifice, but in all cases at this point in the passage of the hand the fundus should be steadied and even pushed down with the external hand to avoid dangerous stretching of the lower uterine segment, or too great traction

Fig. 1114.—Introduction of the Hand in Internal Version. Note that the vulva is widely separated and that the entering fingers strongly depress the perineum.

of the uterine attachments by the upward pressure of the internal hand. The subsequent use of the fingers in combined version, and of the hand in internal version is described under the proper sections.

(A) CEPHALIC VERSION.

Cephalic version is not applicable to cases in which rapid delivery is desired, nor in cases of decided flattening of the pelvis unless the delivery is to be by symphyseotomy and forceps, for in head-first deliveries in flattened pelves we lose the decided advantage secured by breech extraction and the entrance of the head into the pelvic inlet base first. Theoretically cephalic version is to be preferred to podalic version in all but a few exceptional cases, because, as has been stated before, the prognosis for the fetus is always better in cases in which it passes head first through the pelvis than in either spontaneous or artificial feet-first labors. On the other hand, the dexterity on the part of the operator required for its performance, the ease with which podalic version can usually be performed, and the frequent necessity for rapid extraction after version, have unjustly kept cephalic version in the background.

FIG. 1115.—EXTERNAL CEPHALIC VERSION IN BREECH PRESENTATION. Note that the fetus is made to travel occiput first about the uterine cavity.

Indications.—These are very limited, principally in shoulder and breech presentation, but not when rapid delivery is demanded, and hence the method is unsuitable in placenta prævia and prolapse of the cord.

I. External Cephalic Version.—*Indications:* Cephalic version by external manipulation only is chiefly applicable to cases of shoulder presentation or oblique positions of the fetus in the uterus, discovered in the latter part of pregnancy or at the onset of labor. Under favorable circumstances it may also be used to convert a pelvic into a cephalic presentation. After labor has commenced this method may be used if sufficient liquor amnii remains and the uterus sufficiently relaxes between the pains. *Operation:* The dorsal posture of the patient with the pillows removed is to be preferred. As much relaxation of the abdominal muscles as possible must be secured by flexing the thighs. Anesthesia usually is not necessary, but in nervous patients may be required, and employed to advantage. For success it is necessary to make out with certainty

the existing position and presentation of the fetus, this being done by both external and internal palpation. Before the operation is begun a clear mental picture should also be formed of just what is to be done. In shoulder presentations and oblique positions of the fetus it is always desirable to have the head take the shortest road to the pelvic inlet, and in pelvic presentations we should aim to have the fetus revolve occiput first about the pelvis in order to avoid unnecessary extension of the head, provided this can readily be accomplished. With the palm of one hand upon the breech and the other upon the head the breech is carefully pushed up, the head down, until the long axis of the fetus corresponds to that of the uterus and the head lies over the pelvic inlet (Figs. 1115 and 1116). Revolution of the fetus is often readily performed, especially in shoulder presentations, but, the cause of the malpresentation existing, return of the fetus to its original presentation often occurs; this I have found especially true of pelvic presentations. In such cases I have found a pad on each side of the uterus to hold the fetus in place of little use before labor actually sets in, but the case should be carefully watched and reposition again performed at the onset of labor and the fetus held in position until engagement occurs. In private practice I once thus changed a shoulder into a vertex presentation in the beginning of the first stage and held the head at the pelvic inlet by grasping it with one hand externally for three hours, when it finally engaged. No further anomaly occurred and the patient and fetus were thus saved from the dangers of a podalic version. In general, after correction of the malpresentation it is advisable to keep the patient quiet in bed in the dorsal posture so that the fundus uteri shall not incline to one side or the other until the desired presentation is effected. Fixation of the head in the pelvic inlet may be hastened and promoted by artificially rupturing the membranes, as soon as the dilatation of the os warrants it.

FIG. 1116.—EXTERNAL CEPHALIC VERSION IN SHOULDER PRESENTATION.

II. Combined or Bipolar Cephalic Version.—Various methods of performing version by one hand passed into the vagina, one or more fingers of which being passed through the os, and the other hand upon the anterior abdominal wall, have been described by Busch, Hohl, Wright of Cincinnati, and Braxton Hicks of England.* The method as now usually practised is according to the principles

* Hicks: "Combined External and Internal Version," 1864.

laid down by Braxton Hicks, although priority has been claimed for Wright, of Cincinnati.* *Posture of the patient:* Usually the dorsal posture is more convenient for both operator and patient. Hicks advises a choice of lateral position to assist by gravity the performance of the operation. Thus, in shoulder presentation with the fetal head to the patient's left side, and the breech therefore toward the right, Hicks advises the left lateral posture of the patient, so that the effect of gravity upon the fundus will assist in the operation by carrying the breech to the left and the head thus over the pelvic inlet. The reverse may be tried when the fetal head is to the mother's right. As in other varieties of version, so here, the knee-chest posture of the patient has been recommended and used to assist in the recession of a partially fixed shoulder or breech. This posture I have found difficult for the patient to keep for any time, and not more efficient than the exaggerated left latero-prone posture, which any patient can easily assume (Fig. 1051). The right and left exaggerated latero-prone posture can be used as directed. For ordinary cases the dorsal posture will be found the most convenient.

In Shoulder Presentation.—It is in this presentation more than in pelvic that combined cephalic version is used. The term "bipolar" cannot, strictly speaking, be applied to combined cephalic version in shoulder presentation until the latter part of the procedure, when both poles of the fetal ellipse are grasped. Anesthesia is not always necessary but usually desirable, and it certainly facilitates the operation. As in all varieties of version, a certain diagnosis of the exact position of the fetus is necessary for success. The operator should use for the internal hand the one the palm of which would naturally face the fetal breech, or the hand the fingers of which naturally flex toward the fetal breech. Thus in right scapula positions of the shoulder he should use the left hand internally, and in left scapula positions the right hand in the vagina. If possible, he passes two fingers through the os, as thus more force can be secured and there is less danger of rupturing the membranes with two than with one finger. With the external hand steadying the head, the two fingers in the lower uterine segment by a movement of flexion push the apex of the shoulder upward and toward the side of the uterus occupied by the breech; at the same time the external hand, already placed upon the head, pushes the head down into the pelvic inlet, where it is recognized and received by the two internal fingers and further adjusted to the inlet. For the version to be completed the long axis of the fetus must correspond to that of the uterus. In some instances the fetal breech will not readily rotate into the fundus even after the head occupies the pelvic inlet. In such cases it is advisable to withdraw the vaginal hand, the external hand still firmly holding the head at the inlet, and to use this hand to push up the breech into the fundus. It is only at this point in the operation that the operation, strictly speaking, is "bipolar," namely, the forces are applied to the opposite poles of the fetal ellipse. The head must be held by external palpation until it engages or until engagement can be hastened by artificial rupture of the membranes.

In Breech Presentation.—It is often desirable at the onset of labor to convert a breech into a vertex presentation in order to better the prognosis for both fetus and mother. External version should always be tried first, and, failing in this, we resort to combined external and internal version. Under such circumstances the version is, strictly speaking, "bipolar," since force is applied to both poles of the fetal ellipse. *Operation:* The same general principles as to preparation and posture of the patient apply here as in cephalic version in shoulder presenta-

* "Amer. Jour. of Obstet.," vol. VI, Part I, 1873.

tion. As in shoulder presentation, so here, there is a distinct advantage to the operator and the prognosis in the choice of the hand to be used internally. The principle to be followed here as in other varieties of version is to have the fetal ellipse revolve "occiput first" about the uterine cavity. Of course, it is just as short a distance for the head to revolve one way as the other in pelvic presentation. So in left sacro positions of the breech it is advantageous to use two fingers of the right hand in the lower uterine segment, by flexing these fingers to push the fetal breech to the mother's right, and thus the occiput will traverse the left wall of the uterus and there will be little danger of head extension or prolapse of the hands or arms. In left sacro positions the left hand is used externally to push the head around the left wall of the uterus in conjunction with the efforts of the internal right hand. As soon as the breech has disappeared from the touch of the internal fingers these remain quiescent until the apex of the shoulder can be reached, when it is pushed by a movement of flexion with the fingers in the direction the breech has taken. After the shoulder has been passed on, the internal fingers at the os await the coming of the head, as in combined cephalic version in shoulder presentation. If after the bringing down of the head it is found that the fetal breech has not ascended so far as the fundus, the vaginal hand is withdrawn and used to push up the breech, the head being still held in place with the original external hand. In right sacro positions the choice of hands is reversed, as the left hand is used internally and the right externally.

FIG. 1117.—INTERNAL CEPHALIC VERSION. D'OUTREPONT'S METHOD.

III. Internal Cephalic Version.—Before the introduction of internal podalic version internal cephalic version was frequently performed by passing the whole hand into the uterus, grasping the fetal head, and drawing it down into the os. The operation is more difficult than combined or internal podalic version and the maternal prognosis is not so good, although theoretically the fetal prognosis is better. After the introduction of podalic version the cephalic variety was practically abandoned, but has recently been revived. *Conditions necessary:* Complete dilatation of the os with no disproportion between the head and maternal parts. The operation is not intended for rapid delivery. *Operation—method of D'Outrepont:* The uterus is supported with the external hand. The internal hand seizes the presenting shoulder and, during the intervals between the pains, pushes the shoulder upward and in the direction of the breech, until the head descends into the pelvic inlet (Fig. 1117). *Method of Busch:* The head, if on the left side, is grasped by the right hand through the cervix while the other hand carries up the breech; the head is then drawn as far as possible into the cervix by the operator's hand, with the thumb and little finger upon the temples and the other three fingers over the occiput (Fig. 1118). *Vienna method:* By the Vienna method the head is guided to a position over the os by the combined method of Hohl (*q. v.*) and then grasped and drawn into the cervix.

(B) PODALIC VERSION.

Combined and internal podalic versions are performed more frequently than all other varieties, so much so that in America the general term version is almost synonymous with internal podalic version.

Indications.—Podalic version is indicated: (1) in shoulder presentation when cephalic version has failed or the conditions are unfavorable for its performance; (2) in cephalic presentation when the prognosis is bettered by feet-first delivery, as in contracted pelves; prolapse of the cord or extremities; in certain malpresentations and malpositions, such as face and brow presentations, and in persistent occipito- and mento-posterior positions at the pelvic inlet; (3) in certain emergencies either for the control of hemorrhage or for rapid delivery, such as placenta prævia and accidental hemorrhage, eclampsia, or sudden death of the mother.

I. External podalic version is never used, the combined or bipolar and the internal methods being preferred.

II. Combined or Bipolar Podalic Version.—The method used to-day is practically the bipolar method of internal and external manipulation of Braxton Hicks. I shall not enter into a comparison of the difference in the combined methods of Busch,* D'Outrepont,† Wright,‡ Hohl,§ and Hicks,‖ since they differ merely in detail, all simultaneously employing the external and internal hand, but discuss only Hohl's and Hicks's methods, which limit the internal hand to the introduction of one or two fingers through the os. The methods of Busch and D'Outrepont, which required the introduction of the whole hand through the cervix, are to-day practically obsolete. Any method of combined podalic version which necessitates the introduction of the whole hand into the uterus can scarcely give better results than internal podalic version. The priceless advantage of the method described by Hicks is that it can be performed early in labor, or even in late pregnancy, as its only requisites for success are (1) sufficient mobility of the fetus in the uterus; (2) an exact diagnosis of the fetal presentations and position; and (3) sufficient dilatation of the os to allow of the passage of two fingers.

FIG. 1118. — INTERNAL CEPHALIC VERSION. BUSCH'S METHOD.

1. IN SHOULDER PRESENTATION.—Bipolar podalic version may be tried in cases in which external or combined cephalic have failed, or in cases of shoulder

*Scanzoni: "Lehrbuch der Geburtshülfe," 1869, Bd. III, p. 63. †Op. cit., p. 65.

‡Wright: "Amer. Jour. Obstet.," vol. VI, Part I, 1873.

§Hohl: "Lehrbuch der Geburtshülfe," Auflage 1862, p. 784.

‖Hicks: "Combined External and Internal Version," "Trans. London Obstet. Soc.," vol. V, p. 230; "Amer. Jour. Obstet.," July, 1879, p. 593.

presentations in which it is very important to bring down a leg to control hemorrhage, as in placenta prævia, or for purposes of subsequent rapid delivery. In all such cases in which the membranes are intact, or in which they have not long been ruptured, bipolar podalic version can be attempted without any disadvantage or danger to mother or fetus; for should circumstances prevent recession of the shoulder, and version by this method fail, the hand can be passed into the uterus, provided there is sufficient dilatation, and internal podalic version promptly performed. *Operation:* Anesthesia as in combined cephalic version is

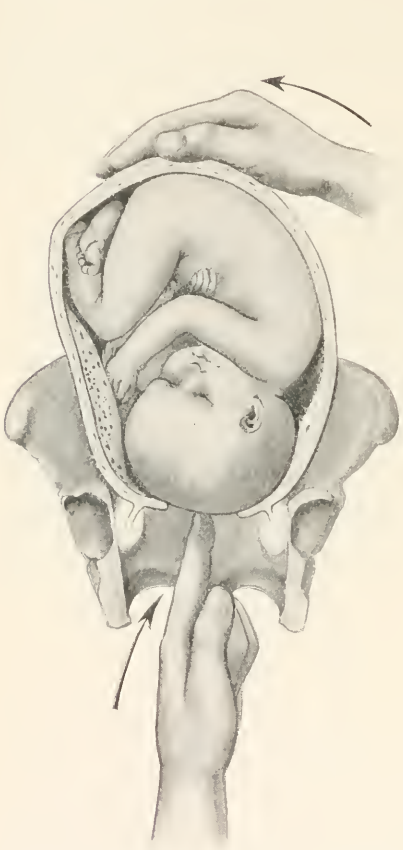


FIG. 1119.—COMBINED OR BIPOLAR PODALIC VERSION. BRAXTON HICKS'S METHOD. FIRST STEP.

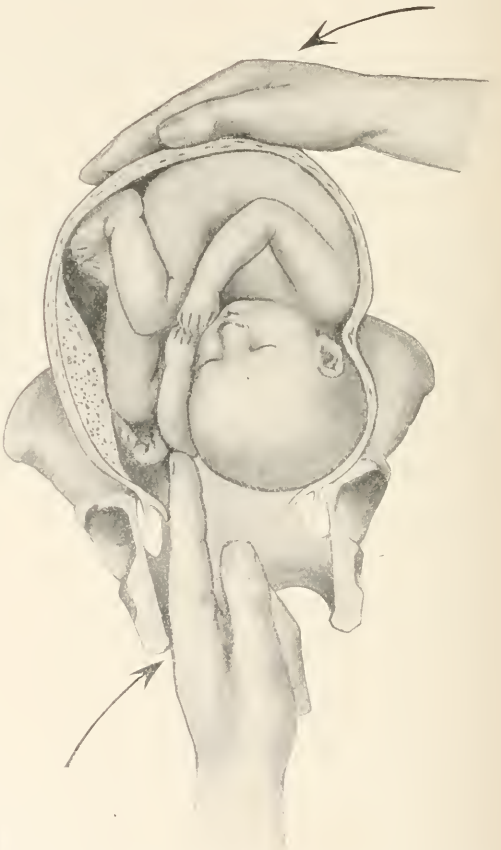


FIG. 1120.—COMBINED OR BIPOLAR PODALIC VERSION. BRAXTON HICKS'S METHOD. SECOND STEP.

a practical necessity. The dorsal posture of the patient upon a sufficiently high table is usually to be preferred, although the lateral or exaggerated semiprone can be substituted in difficult cases. (See page 872.) The internal hand should be the one whose fingers naturally flex toward the fetal head; thus, in left scapula positions the left hand is used internally, and in right scapula positions the right hand. The proper hand is introduced into the vagina and two fingers are passed through the os. The external hand rests over the fetal breech. Now with the internal fingers the presenting shoulder is gently pushed upward in the direction of the head and at the same time somewhat toward the fundus. This

latter movement brings the fetal abdomen in part over the os, and renders descent and grasping of a foot more easy. At the same time, with the external hand the breech is pushed down into the lower uterine segment to replace the shoulder. If this substitution can be accomplished, the most available knee or foot, which is usually the anterior, is sought for by the internal fingers and hooked down into the vagina through the os. When once the knee or foot is caught, the external hand is transferred from the breech, which it has been pushing down, to the lower portion of the fetal head, which it pushes upward and into the fundus uteri. The ease with which the operation is performed will depend, of course, upon the mobility of the fetus in the uterus, and practically upon the amount of liquor amnii. It is generally considered that prolapse of an arm renders the performance of combined podalic version in shoulder presentation impossible. Dr. Frank P. Foster, of New York,* operated in such a case by using the prolapsed arm as an aid to the version. The pre-

FIG. 1121.—COMBINED OR BIPOLAR PODALIC VERSION. BRAXTON HICKS'S METHOD. THIRD STEP.

FIG. 1122.—HALF BREECH FORMED WHEN ONE LEG IS BROUGHT DOWN IN PODALIC VERSION.—(*Leopold.*)

sentation was a shoulder and the position right scapula anterior with the left arm prolapsed into the vagina. With the right hand in the vagina Dr. Foster grasped the arm, and, using it as a kind of handle, gently pushed upward in the direction of the humerus. The shoulder and cephalic pole of the fetus were thus elevated, and with the index-finger in the cervix the breech was reached and pushed in the direction the head had taken until the leg was recognized and brought down.

2. IN CEPHALIC PRESENTATIONS.—(Figs. 1119 to 1122.) The indications and conditions necessary for the performance of bipolar podalic version in cephalic presentation—namely, vertex, brow, and face—are practically the same as in

*Foster: "On Prolapse of the Arm in Transverse Presentations," "Amer. Jour. of Obstet.," vol. IX, p. 203.

shoulder presentation. The head must not be too firmly engaged. *Operation:* Anesthesia here is also a necessity and the dorsal posture is to be preferred in ordinary cases. As in shoulder presentation, a movable fetus and an exact diagnosis of the presentation and position are necessary for success. It is important that the fetus shall revolve occiput first about the uterus. This causes the feet to travel about the shortest possible distance in order to reach the cervix; there is less danger of extended head and arms, and the revolution of the fetus thus is more readily accomplished. Hence, contrary to many authorities, I believe that there is a distinct choice in the hand used internally. In left dorso positions the left hand should be used internally, and in right dorso positions the right hand. (1) With the appropriate hand in the vagina, two fingers through the os, and the external hand on the breech, the internal fingers by a movement of flexion gently push the head upward and in the direction of the occiput, the external hand at the same time pushing the breech by a gentle sliding motion in the opposite direction. This is to be continued until the head has passed out of the reach of the internal fingers. (2) As the head departs from the internal fingers, if all goes well, the normal attitude of the fetus is preserved and no extension of the head or displacement of the arms occurs. The external hand now simply continues its pressure and forces the breech with the feet into the lower uterine segment, where one of the latter or a knee is secured by the fingers of the internal hand. In less favorable cases, by reason of the uterus enveloping the fetus too closely, extension of the head takes place; it does not readily pass upward along the side of the uterus into the fundus, and the shoulder or fetal chest is felt by the internal fingers just over the os. In such cases one must treat the shoulder or chest in the same way as the head by gently pushing it upward in the same direction the head has taken. Care should be used in this case not to confound an elbow with a knee. (See page 931.) As soon as a knee or a foot is recognized it should be seized, and the membranes be ruptured if still intact. (3) After the knee or foot is firmly secured by the internal fingers, the external hand is transferred from the breech to the other side of the abdomen and placed below the head, which is by a gentle sliding motion pushed upward into the fundus, while at the same time the foot is drawn down through the os into the vagina. Some operators always bring down a knee through the os and afterward extend the leg in the vagina, claiming that a better grasp is to be had in the flexure of the knee than on the foot. I have found it much more convenient and simple to seize the foot in the uterus, as it will be found that the foot comes first within reach of the internal fingers. The leg being through the os, traction should be made upon it until two-thirds of the thigh has passed through the os and the half breech is beginning to enter. This will bring the foot outside the vulva. As traction is thus being made upon the leg, external palpation is used to make sure that the head occupies the fundus. Traction on the leg until the thigh engages in the os, combined with external upward pressure on the head, assists in completing the version and preventing recession of the part engaged. When the long axis of the fetus corresponds to that of the uterus the version is completed. Whatever is subsequently done in the way of extraction will be quite another operation. *Choice of the leg to be seized:* It is generally stated that in combined podalic version in head presentations there is no choice as to which leg is seized and that it makes no difference whether it is the anterior or posterior which is secured. There is a principle in all varieties of internal version, namely, that the leg which is brought down always eventually rotates forward behind the symphysis. This rule has few exceptions. Hence it will be found expedient, in order to avoid unnecessary rotation of the fetus within the uterus, always to attempt at least to seize the anterior knee or

foot, unless some distinct indication to the contrary exists. There is practically but one exception to the rule of seizing the anterior foot, and that exception exists in flattened pelves after it has been definitely determined that more room exists on one side of the pelvis than the other on account of the greater width of the sacral ala on one side. In such a contingency it is desirable to bring the occiput and the wide biparietal diameter into the roomiest lateral half of the pelvis. Since, as stated above, the leg which is brought down always eventually rotates to the symphysis, if we desire the occiput to occupy a roomy left side of the pelvis we bring down the left foot, and the right if we want the occiput in the right half. Fig. 882 (page 650) illustrates the type of pelvis referred to, in which, as will be seen, the roomiest lateral half of the pelvis is the left half. It is not by any means always possible to choose a given knee or foot with two or three fingers only in the lower uterine segment, hence in cases in which the choice of the leg to be seized is important in the prognosis, it is better to wait until spontaneous or artificial dilatation is accomplished, to pass the whole hand into the uterus and to select the desired leg, thus practically doing an internal podalic version. (Compare page 933.)

III. Internal Podalic Version.—This is one of the most valuable resources in obstetric emergencies. It is indicated when the safety of the mother or child requires immediate delivery, and when the use of the forceps is contraindicated (*e. g.*, in placenta prævia, puerperal eclampsia, prolapse of the cord, etc.). It is also indicated in various malpositions in which natural delivery or delivery by forceps is hazardous or impossible (*e. g.*, in delayed first stage due to occipito-posterior position, or to face presentation), and in cases in which the after-coming head is better adapted than the fore-coming head to pass through the birth canal (*e. g.*, in flattened pelvis). Internal podalic version in both cephalic and shoulder presentation is to-day performed so frequently that when the term version is used it is often, if not always, understood to mean internal version. *Operation:* The operation consists in the introduction of the whole hand into the uterus, seizing a foot or two feet, bringing it or them into the vagina through the os, and pushing the fetal head into the fundus by external manipulation with the external hand. Unfortunately the version by the internal method is most easy of performance, hence it is often done without first giving external or combined version a trial. It should ever be borne in mind that the operation of internal podalic version, whether in shoulder or cephalic presentation, is a serious operation and one not lightly to be undertaken; that there are always distinct dangers of injury to the maternal soft parts, even to the extent of rupture of the uterus; that the danger of the introduction of septic material and air into the uterus and to the placental site is ever present; that podalic version once completed means the delivery of the fetus spontaneously or, as usually occurs, artificially feet first, and that in such delivery the mortality is always greater for the fetus, and the morbidity for the mother, than in most cases of spontaneous or artificial head-first deliveries. The fetus was intended by nature to pass head first through the pelvis. Reverse nature's process and the breech, a poorer dilator than the head, is the first to pass through and dilate the passages; then come the dangers of arms extended over and impacting the head; extension of the head increasing the danger, and the delivery of the incompressible head rapidly, in ten minutes at most, through passages imperfectly dilated by the fore-coming breech.

Conditions Necessary and Contraindications.—Pelvic deformity must not be too great, nor must it be of such a kind as to interfere with the passage of the after-coming head. The cervix must be completely dilated. If this is not

the case, complete manual dilatation and paralysis should be secured as a prerequisite. In rare cases incision may be necessary. There must not be tetanic contraction of the uterus, and it is highly desirable that the membranes should not be ruptured or should only recently have ruptured. The presence of the contraction ring above the fetal head or more than four inches above the symphysis renders the operation extremely hazardous, owing to the danger o uterine rupture. If the head is impacted or firmly wedged in the pelvic inlet, so that much pressure is required to dislodge it, version is of course contraindicated. Version should not be performed for the delivery of a very small or of a premature child, unless the forceps is contraindicated, for forceps delivery in these cases is usually easy, and if properly performed less likely to be

FIG. 1123.—INTERNAL PODALIC VERSION IN CEPHALIC PRESENTATION. Introduction of the internal hand into the uterus, and downward pressure of the external hand to bring the legs within reach of the internal hand.

FIG. 1124.—INTERNAL PODALIC VERSION IN CEPHALIC PRESENTATION. Grasping the anterior leg with the internal hand and upward pressure upon the anterior shoulder with the external hand.

fatal to the child. Internal version should not be performed for the delivery of a macerated or dead fetus. If the child is dead, craniotomy should be performed unless the delivery promises to be very easy and unattended by laceration of the maternal structures.

General Preparations.—The dorsal posture of the patient upon a high operating table is to be preferred to the lateral, exaggerated semi-prone, knee-chest, and Trendelenburg postures, in all but exceptional cases. In difficult versions in impacted shoulder presentation the Trendelenburg and exaggerated semi-prone position will greatly assist our endeavors to dislodge the impacted shoulder. (See page 879.) The bladder and rectum must be thoroughly emptied, the pubic hair removed, and I am accustomed to prepare the external genitals, adjacent parts,

and vagina, as for a major gynecological procedure; vaginal hysterectomy, for example. Of course, vaginal mucus and lubrication are thus removed, but it will be found that a good substitute is a 1 per cent. solution of lysol, with which the vagina should finally be freely irrigated. Anesthesia is a necessity in internal version, as it is important for the maternal and fetal prognosis that the greatest possible relaxation of the uterus be obtained. Theoretically, chloroform gives a more thorough uterine relaxation than ether, but it will be found that ether, if properly given, will answer every purpose, and it is certainly the safer anesthetic. (Compare Anesthesia, page 865.)

1. In Vertex, Bregma, Brow, and Face Presentations.—The prepara-

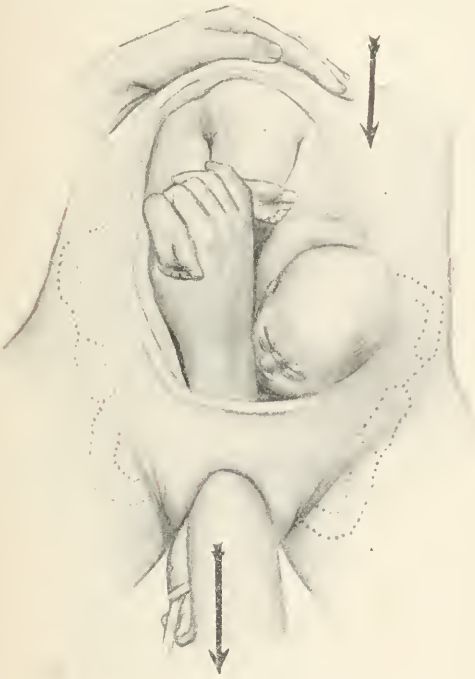


Fig. 1125.—Internal Podalic Version in Left Scapulo-posterior Position of the Shoulder. The right hand is used internally to grasp the feet, and the left externally to depress the fundus. This method is not recommended.

Fig. 1126.—Internal Podalic Version in Left Scapulo-posterior Position of the Shoulder. The left hand, the palm of which naturally faces the fetal abdomen, is used internally to grasp the feet, and the right hand externally to depress the fundus. This method is to be preferred to that of Fig. 1125.

tions having been carefully made, here, as in other varieties of version, success depends upon an accurate diagnosis of the presentation and position. Our object in internal podalic version in cephalic presentations is to pass the whole hand into the uterus, seize one or two feet, bring the latter into the vagina, and assist the head with the external hand to pass upward and occupy the fundus of the uterus.

Choice of Internal Hand.—According to many authorities, the primary choice of hands is not a matter of great consequence. I believe, however, the choice of hands to be an important factor in the prognosis; and the greater the operator's experience, the greater care will he exercise in this respect. That

hand should be used internally the palm of which naturally without exaggerated pronation or supination faces the fetal abdomen. Thus, in left dorso positions —namely, left occipito-anterior and -posterior, right mento-anterior and -posterior, and right fronto-anterior and -posterior—the left hand is the one to use internally for grasping the foot or feet, as this hand most naturally by the shortest path and with least disturbance of the fetal ellipse comes to the feet and readily selects one or both for traction. However, in right dorso positions—namely, in right occipito-anterior and -posterior, in left mento-anterior and -posterior, and in left fronto-anterior and -posterior—the right hand should be used, for the above reasons. In pelves flattened from any cause, and especially if the pelvic inclination is increased, there may be a decided posterior obliquity of the uterine axis in reference to the axis of the pelvic inlet, with a perfectly movable head. Under such circumstances rotation of the fetal back often occurs and the feet are found not to one side, but well up against the posterior wall of the fundus. Here, of course, it is immaterial which hand is used internally, but in the great majority of cases

Fig. 1127.—Method of Grasping One Foot.

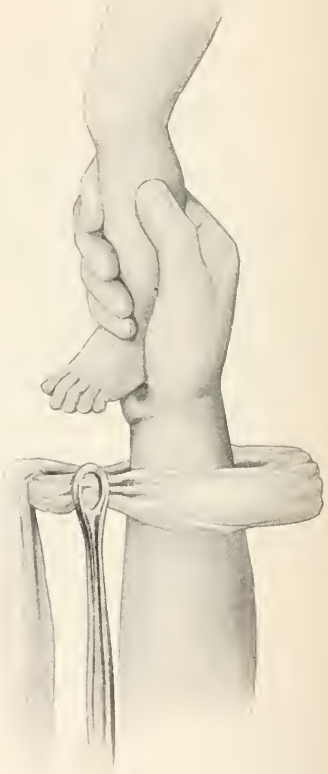


Fig. 1128.—Method of Passing a Sling over a Foot Prolapsed into the Cervix or Vagina.

of cephalic presentation external and internal examination will reveal the fetal dorsum inclined either to the left or right.

Treatment of Intact Membranes.—If internal version is to be performed when the membranes are intact, and it is most desirable and advantageous that they shall remain unruptured until the hand is introduced into the vagina, and the liquor amnii thus being dammed back in the uterus after the membranes are finally artificially ruptured, the question is often asked, What is the treatment of the unruptured membranes? Three plans have been practised by various authorities in time gone by: (1) One plan is to seize the foot or feet through the unruptured membranes and complete the version without rupturing them; (2) another is to

pass the internal hand up between the uterine wall and membranes until opposite the feet and then rupture; (3) and the third is to rupture the membranes at the level of the os and introduce the hand into the amniotic cavity during the escape of the water. The first plan is to-day practically obsolete, and the passage of the hand up until opposite the feet, as in the second plan, carries with it unnecessary dangers of septic infection, accidental hemorrhage from premature placental separation, and rupture of the uterus. I have seen several cases of alarming ante-partum hemorrhage from this method. It is not to be recommended. The third method of low rupture is the safest of all and quite as satisfactory as any other. In this method there is no danger of accidental hemorrhage; the liquor amnii is quite as readily dammed back in the uterus by the wrist and forearm in the vagina; and then we have the great advantage of working entirely within the membranes from the internal os, they forming, so to speak, a protecting glove covering the internal hand and reducing the dangers of infection to a minimum (Fig. 637).

Further Course of the Internal Hand.—In the absence of uterine contraction, the internal hand should gradually be passed within the bag of membranes upward toward the fundus and along the lateral uterine wall, disturbing the fetal ellipse as little as possible. During the entire time the external hand must make careful counter-pressure over the fundus until the feet are seized. If a uterine contraction at any time occurs, all upward movements of the internal hand must cease and the hand lie flat against the uterine wall until the contraction has passed off. Some difficulty will usually be encountered in passing the presenting head. This, as a rule, can be overcome by gently pushing it toward the iliac fossa opposite the internal hand. In late internal podalic versions in cephalic presentations attention must be paid to the condition and location of the contraction ring. Should one palpate the contraction ring projecting markedly toward the fetal head,—and there is difficulty, under deep anesthesia, of passing the hand by this ring,—the version should be abandoned, since the conditions indicate retraction of the body of the uterus, ascent of the retraction ring, and dangerous thinning of the lower uterine segment. There would be great danger of uterine rupture in attempting to displace the head upward and over such a retraction ring.

Choice of Leg to Bring Down.—Shall we seize one or both feet; and, if one foot, the knee or foot, the anterior or posterior leg? If both legs only are brought down and not one leg alone, the whole breech makes a better dilator for cervix, vagina, and vulva than the half breech (Fig. 1122), and hence the fetal prognosis is improved because a fuller dilatation of the passages diminishes the danger of the after-coming head and the disengagement of possibly extended arms. If the fetus is dead or macerated; if it is small or medium-sized; and if in the interest of the mother great haste is essential, the grasping of both legs wil also be indicated. If both legs are brought down, the feet are seized. There are two advantages in seizing a knee and not a foot when one leg is brought down first: the knee in a normal attitude is nearer the os than is the foot, and, second, the flexure of the knee offers a convenient hold. One foot is difficult to grasp within the uterus without doubling the hand into the shape of a closed fist, and this occupies much space. On the other hand, the knees lie near the elbows, and differentiation with fingers whose sensation is partially lost by reason of uterine pressure is not always easy. To distinguish the knee from the elbow, one should recall that the knee is relatively broad, has not the sharp projection of the olecranon, and usually points toward the head; while the elbow is sharp and points away from the head. In doubt, one can follow along the extremity and differentiate hand from foot, or in the opposite direction and distinguish shoulder from

breech. When the knee is selected, the forefinger is slipped into the fold of the popliteal space, the knee is drawn down through the os into the vagina, and the leg then extended and subsequent traction made upon the leg. As regards the *choice of legs* when one is seized, many authorities state that it makes no difference which is selected; that the best plan is to seize whichever comes first and is most readily found. As stated elsewhere, whichever leg is seized in version eventually comes to the pubic angle, hence to avoid unnecessary torsion of the fetus it will

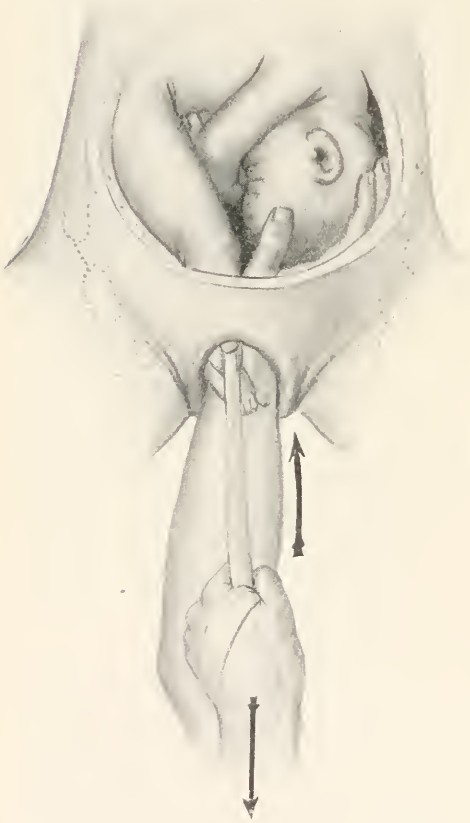


FIG. 1129.—DIFFICULT PODALIC VERSION IN CEPHALIC PRESENTATION. Combined manipulation, consisting in upward pressure upon the head with the hand in the uterus, and downward traction with a sling attached to a prolapsed leg.

FIG. 1130.—THE COMPLETION OF PODALIC VERSION. The version is finished when the knee is at the vulva, and the long axes of fetus and uterus correspond.

be found advantageous always to select the anterior leg. To sum up, the plan I have found most successful is to seize the knee when one leg is to be brought down and the feet when both. I always endeavor to bring down the anterior leg in single-leg versions.

Difficult Internal Version in Cephalic Presentation.—If one encounters difficulty in the rotation of the fetus, the same two expedients may be used as are made use of in difficult internal podalic version in shoulder presentation. The manœuvers constitute the so-called combined manipulations. One is by me-

chanical means to apply greater traction on the leg than we are able to do with the hand; and the second is, by an arrangement of the soft fillet or sling to draw down on the leg or legs while we push up the head internally (Fig. 1129). These methods are described on page 935, under "Version in Impacted Shoulder Presentation." It must ever be remembered that in cephalic presentation difficult version by the combined manœuver is usually a more dangerous procedure for the integrity of the uterus than is an operation of equal difficulty in shoulder presentation. Moreover, difficult version in a cephalic presentation is almost always undertaken in the interests of the fetus; namely, in malpresentations and malpositions; hence if the resistance to the rotation of the fetus is very great, we must be careful not to persist and thus run too great a risk of uterine rupture.

2. In Shoulder Presentation.—The preparation and the general principles are the same as in cephalic presentation.

Choice of Internal Hand.—Because the feet are usually within easy reach in the center of the uterus, the choice of hand is not so important as in cephalic presentation. In general, the hand should be used the palm of which most naturally faces the legs. Thus, in left scapula positions of the shoulder I always use the left hand internally to grasp the foot or feet, and in right scapula positions, the right.

Treatment of Intact Membranes.—This is practically the same as in cephalic presentation.

Choice of Leg to Bring Down.—Some operators attach little importance to the choice between the upper or lower leg, and seize either foot indifferently. In Germany preference is given to the lower leg, and in England the followers of Simpson teach the doctrine of selecting the leg on the side of the body opposite to the presenting shoulder. I hold that a distinct choice exists here, although in extreme emergency, when the time does not allow of a positive diagnosis of the position, one is only too glad to seize the first foot available. A study of the mechanism of labor in pelvic presentation will convince one of the importance of the fetus maintaining a dorso-anterior position. Further, in order that the fetal attitude may be disturbed as little as possible, it is necessary that the leg selected shall take the shortest road to the pubic arch. Both of these conditions are fulfilled by selecting the lower leg in scapulo-anterior positions, and the upper leg in scapulo-posterior positions.

Sling to the Prolapsed Arm.—In case an arm is prolapsed in the vagina or through the vulva, there should never be any attempt at replacing it, but a sling should be attached to the wrist, affording a distinct advantage. The operator has thus complete control over one arm at least, and he will always be able to prevent this arm from becoming extended above the head and so delaying the extraction of the after-coming head. (Compare "The Sling.")

Version in Impacted Shoulder Presentation.—In instances in which version is demanded after the membranes have been ruptured for some time and the uterus is closely contracted around the fetus, we may find much difficulty in moving the fetus, after the leg has been even seized, and with the assistance of external manipulations. Three expedients will here usually prove successful, although in the case of a dead fetus and dangerous thinning of the lower uterine segment decapitation is the safer operation. First, an anesthetic to the full surgical degree is demanded, in order to secure the greatest possible relaxation of the uterus. Second, some means is employed to secure more powerful traction on the leg than can be obtained with the internal fingers. The best way of making powerful traction is by the aid of the sling (Figs. 1128 and 1129). Third, the

internal hand is used not to draw down on the leg, but firmly to push up on the shoulder. The sling to the leg leaves ample room for this, and we thus bring two forces simultaneously into play on the opposite poles of the fetal trunk (Fig. 1129). In very difficult cases the second leg can be brought down, a sling applied to it, and traction made on both legs simultaneously.

(D) PELVIC VERSION.

Pelvic version, in which the breech is caused to present by external, combined, or internal manipulation, without a leg being brought down, is to-day rarely performed, being practically obsolete. The same general principles as in cephalic or podalic version govern its performance.

Prognosis.—In the 44 cases analyzed by the author, one mother died from rupture of the uterus following manual dilatation and internal podalic version for placenta prævia. Of the children, 32, or 72.5 per cent., were delivered alive; 7, or 15.9 per cent., were still-born; 1, or 2.27 per cent., died in the puerperium, and in 5 there was no record of the result. (Compare Forceps.) Forceps operation was attempted in 6 cases prior to the version.

XII. PELVIOTOMY.

Symphyseotomy is so well, if not so favorably, known that the practitioner generally ignores the fact that this particular form of intervention is but one of several methods of dividing the pelvic ring. **Double Ischio-pubiotomy:** A few years after Sigault's introduction of symphyseotomy, Aitken performed an operation for enlarging the pelvic cavity by sawing through the two rami of the ischium and those of the pubis on either side of the pubic bone. **Double Pubiotomy:** Pitois modified this operation by carrying the incisions through the pubic bone on both sides of the symphysis. **Triple Pelviotomy:** Finally Galbiati, the distinguished symphyseotomist, added ischiopubiotomy to symphyseotomy, thus dividing the pelvic ring in three different localities. These operations were practised as a variation or extension of the principle of symphyseotomy, in cases in which the latter operation could not sufficiently enlarge the pelvic cavity; such a state of affairs could hardly occur save in high degrees of pelvic contraction, ankylosis, or deformity, or in some condition of the symphysis in which its division is contraindicated. Operations dividing the pelvic bones have been looked upon as obsolete, being supplanted, since the antiseptic era, by artificial premature delivery, Cæsarean section, etc. However, in 1892 Farabeuf revived this principle by recommending and practising ischiopubiotomy (unilateral) in the asymmetrical ankylosed pelvis.

Unilateral Ischio-pubiotomy.—This operation, according to Farabeuf, is one which may be performed by any practitioner without difficulty or risk. Its technique is as follows: The cutaneous incision should be parallel with the median line and at a distance of $1\frac{1}{2}$ inches (4 cm.) from it. The rami of the ischium and those of the pubis are thereby exposed sufficiently for the passage of a chain-saw around them. The ramus of the ischium is to be divided by the side of the perineum, to the right of the fourchette; the ramus of the pubis is to be divided a finger's-breadth to the outer side of the pubic bone. A finger should be kept in the vagina during the various steps which end in the division of the ramus of the pubis. After the pubic bone has been exposed by incision through

the soft parts, a curved rasp is used to denude its outer aspect, lower border, and inner aspect of the bone, the instrument reappearing at the obturator foramen. The chain-saw is passed around the bone by the aid of a blunt curved needle, the soft parts are pushed back, and the bone is sawed through. The ramus of the pubis is divided in a similar fashion, care being taken to respect the inguinal canal. The pectineal aponeurosis and Gimbernat's ligament are detached from the bone. The saw can be passed around the latter with very little preliminary denudation. No separation of the bones occurs thus far, because it is prevented by the obturator membrane, which must be disconnected from the pubic ramus. With the aid of some strong, blunt instrument the severed bones are now pried apart. The amount of separation obtained thereby is at least 1.1 inches (3 cm.). After delivery the ramus of the pubis should be wired together by strong metallic sutures. Ischiopubiotomy, being simply a variation of symphyseotomy when the latter is insufficient, comprises certain principles which will be considered in detail under the latter operation.

XIII. SYMPHYSEOTOMY.

Symphyseotomy, or division of the ligaments which unite the two halves of the pubic bone, is an operation introduced into obstetrical surgery for the purpose of enlarging the pelvic inlet in dystocia arising from disproportion between the pelvis and the fetal head. It is quite radical as a piece of operative intervention; for despite the apparent simplicity of the operation proper, it may be regarded as a crucial example of work.

Indications.—Symphyseotomy may be regarded as an independent procedure, or as a mere accessory to version, high forceps extraction, etc. Broadly speaking, it is a method for enlarging the pelvic cavity, and has many uses in theory which cannot be realized in practice. Chrobak* states that there is hardly an obstetric operation in which symphyseotomy might not be employed as an adjuvant. The operation of division of the joint itself is insignificant in its consequences, and the real complication lies in the injuries necessarily inflicted upon the soft parts. Hence symphyseotomy as an adjuvant to other obstetric operations must necessarily add to the risk already present. The indications and contraindications for symphyseotomy necessarily vary with the point of view of the operator. The intervention is ostensibly to save the child without thereby imperiling the life of the mother. The Italian symphyseotomists, Morisani and Novi, do not look upon premature delivery, Cæsarean section, and symphyseotomy as competitive but as entirely distinct procedures, each having its own special indications and contraindications. It is essential for the success of symphyseotomy that the pelvis be not too small for the expulsion of the child, for the subsequent application of the forceps must add greatly to the risk for both mother and child. It is also essential that the child be able to come into the world alive. Symphyseotomy is indicated if the conjugate is between 3.46 inches (8.8 cm.) and 2.64 inches (6.7 cm.). If this condition is insisted upon, the results of intervention are seen to be excellent. It is, however, regarded as an error to make the indication for symphyseotomy depend wholly upon the dimensions of the conjugate, as some account must be taken of the shape of the pelvis as a whole. Symphyseotomy is especially indicated in certain types of pelvic deformity, such as the funnel-shaped pelvis, sacro-coccygeal ankylosis, etc. In the justo-minor pelvis the operation is indicated

*Cited by Neugebauer, p. 197.

without too implicit adherence to the size of the conjugate. Other indications for symphyseotomy are found in normal pelves with excessive size of fetal head, or in the presence of deformities. Neugebauer, who has doubtless devoted more time to the study of symphyseotomy than has any other individual, with the possible exception of Morisani, states that the operation possesses a strict indication, standing midway between artificial premature delivery and Cæsarean section, with the former of which it may also be combined to save the life of the child. My experience in six cases of flattened and generally contracted pelves does not lead me to look with favor upon the operation. I am accustomed to consider the induction of premature labor and Cæsarean section, and in special cases even embryotomy, as competitive with symphyseotomy.

Morbidity.—Rubinrot's analysis teaches us that the operation of symphyseotomy abounds in accidents. The number of post-operative complications is not less formidable. Shock occurs but rarely, but septic accidents are present in not less than 30 per cent., this proportion including mild as well as severe forms. There were 10 deaths from sepsis in 136 operations. Simple suppuration of the

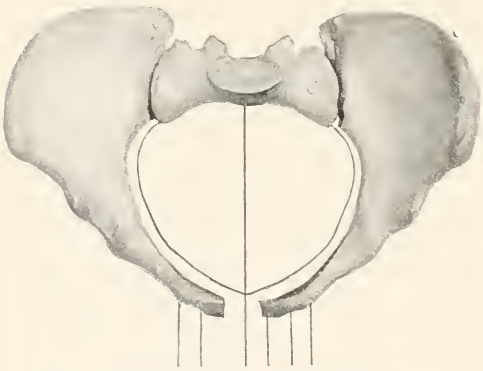


FIG. 1131.—TRANSVERSE SECTION OF A PELVIS JUST BELOW THE PELVIC INLET, MOUNTED UPON A SCALED BOARD TO ILLUSTRATE SYMPHYSEOTOMY.

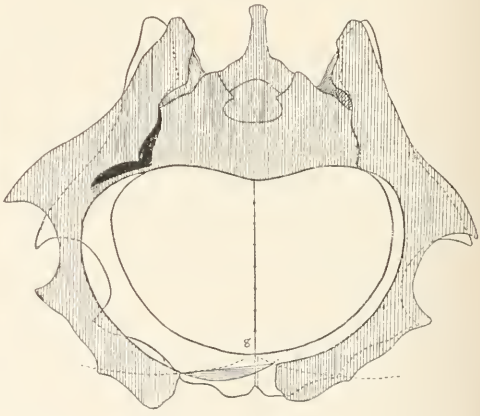


FIG. 1132.—ASYMMETRIC SEPARATION AT THE PUBIC AND SACRO-ILIAC JOINTS IN SYMPHYSEOTOMY.

symphyseotomy wound occurred in about 10 per cent. of all cases, and œdema of the vulva in nearly the same proportion. Of the more unusual post-operative complications may be mentioned hematoma, abscess, stitch-abscess, fistula, permanent separation of the pubic bones, lymphangitis, cystitis, incontinence of urine, paresis of the bladder, urinary fistula, bedsores in various localities, infectious myelitis, neuralgias, and arthritis or other disorders of the sacro-iliac synchondrosis. In addition to the foregoing, a more remote series of post-operative accidents should be mentioned, the presence of which is apparent for months after the operation; namely, disturbance of the gait, which is due to permanent separation of the symphysis, sacro-iliac disease, etc., bony sequestra, urinary incontinence and fistulæ, vesical paresis, cystitis, and sepsis. Sepsis, the most redoubtable post-operative complication, appears to be connected especially with hemorrhage, whether due to the intervention itself or to uterine inertia, and with lacerations of the parturient canal, independent of coincident hemorrhage. In other cases no cause for sepsis is apparent. It has been claimed that sepsis after symphyseotomy is especially favored by the jagged, uneven character of the opera-

tion-wound, which latter is in marked contrast with the clean-cut incisions of the Cæsarean section. More or less stormy convalescence followed all of my six cases of symphyseotomy.

Mortality.—According to Rubinrot's analysis of 136 cases of symphyseotomy from 1896 to 1898, the combined maternal mortality was in round numbers 11 per cent. Fifteen of the women died; two directly from the operation itself and thirteen from post-operative complications (sepsis). This percentage is in harmony with that obtained by Morisani for 241 miscellaneous operations performed before 1894, and by Neugebauer in his analysis of 278 cases. In regard to the infantile mortality, Rubinrot records 19 deaths in 136 operations, or nearly 14 per cent. These figures are higher than those of Morisani, who places the infantile mortality at 12 per cent. This contrast is somewhat paradoxical, as Rubinrot's statistics refer to purely modern operations, while Morisani deals with all the cases since the first introduction of the operation. The infantile mortality appears to be due to a variety of affections and by no means necessarily to the operation. A certain number of deaths are due to attempts at forceps extraction before the performance of symphyseotomy, as shown by the presence of meningeal hemorrhage, fracture of the skull, etc., found at autopsy. Some of the deaths are such as are inevitable in ordinary labor, *e. g.*, from prolapse of the cord, eclampsia of the mother, etc. Generally speaking, the infantile mortality is rendered high by reason of the prolonged sojourn of the child in the maternal passages, the use of anesthetics, shock, etc.,—all of which conditions tend naturally to favor still-birth, apparent death, asphyxia, etc. A very large proportion of children delivered by symphyseotomy require reanimation.

OPERATION.

At the present time the operative technique is practically made up of three distinct methods, each of which is upheld by the operators of a particular nationality. Thus we have (1) the French or open method as performed by Pinard and his followers; (2) the American or subcutaneous method; and, finally, (3) the suprapubic method of Morisani and his pupils. All the French operations from 1896 to 1898 inclusive were done in the classical manner prescribed by Pinard and Farabeuf save those of Porak, who employs a method of his own. The French method was also employed in most of the operations outside of France. Morisani's method, which prevails in Italy, was occasionally employed in other countries, notably in America. Several Americans have operated by the subcutaneous method, while Franck in Germany and Lauro in Italy have devised modifications of symphyseotomy which go by their names.

Italian or Suprapubic Method (Fig. 1133).—The original method employed by Morisani, otherwise known as the Italian or suprapubic operation, is as follows: A transverse incision 1.18 inches (3 cm.) long is made 0.39 inch (1 cm.) above the pubis with the design of exposing the upper margin of the bone. The Galbiati knife is then passed behind the symphysis, as far as its lower border, and with a stroke of the instrument from behind upward and from below upward, the symphysis is divided. Morisani then waits for spontaneous expulsion, and if this is not forthcoming the forceps is applied. The cutaneous incision is then repaired and an immovable dressing of plaster-of-Paris or silica is applied about the pelvis. Novi's method is practically the same, save that he uses a bistoury instead of Galbiati's knife. He applies after the operation a simple spica bandage, not reinforced in any manner. A special symphyseotome has been devised by Spinelli, which is manufactured in three sizes. In order to use this instrument

the suprapubic incision does not suffice and the symphysis must be laid bare. Morisani sometimes employs a bistoury in place of Galbiati's knife. He appears to content himself with a simple roller bandage to secure the apposition of the pelvic bones. The Italian method as practised by Morisani and Novi is peculiar in that the symphysis is divided from behind forward and from below up-

FIG. 1133.—THE ITALIAN OR SUPRAPUBIC METHOD OF OPERATION.

FIG. 1134.—THE FRENCH OR OPEN METHOD OF OPERATION.

ward, and that no attention is given to the insertion of the recti, or to the clitoris and its vessels. The chief care lies in the dissection of the retropubic tissue to

FIG. 1135.—SUBCUTANEOUS OR AYERS'S METHOD OF OPERATION.

make a passage for the knife. Charpentier (quoted by Neugebauer) was much impressed by the singular unanimity of the Italian operators as to technique.

French or Open Method (Fig. 1134).—Pinard's method, otherwise known

as the French or open operation, is as follows: The mons veneris is shaved, and it is regarded as an essential step to make the incision exactly in the middle line. The skin and subcutaneous tissues are divided, the incision being, as a rule, 3.15 to 3.9 inches (8 to 10 cm.) in length, extending from above the pubis to just above the clitoris, deviating a little from the middle line in order to avoid wounding the vessels of the clitoris. The insertion of the recti is divided in the upper angle of the wound, so that the finger may enter the prevesical space and protect the bladder. The symphysis is then divided with a few strokes of the knife from above downward and from before backward. If the separation of the pubic bones is insufficient, Pinard has his assistants enlarge the breach by appropriate pressure upon the lower extremities. The ligamentous mass beneath the symphysis is divided last of all. Before waiting for the expulsion of the child, the symphysis is carefully examined to see if detachment is nearly complete. If convinced that the sacro-iliac articulation will permit sufficient separation of the pubic bones, Pinard immediately applies a temporary dressing to the cutaneous wound and leaves to the patient the task of expelling the fetus. In the open method some operators insert periosteal sutures into the pubic bones before closing the cutaneous wound, and one accoucheur, Fieux, of Bordeaux, regards this periosteal suture as quite sufficient for immobilizing the pelvis. Others employ mechanical devices to retain the pelvic bones in apposition.

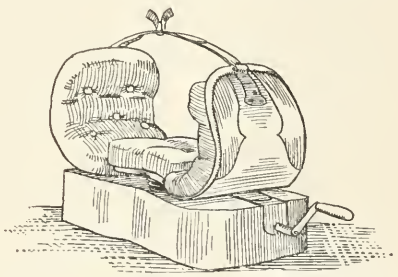


Fig. 1136.—Mechanical Brace for Holding the Joint after Symphyseotomy.

Subcutaneous or Ayers's Method (Fig. 1135).—The subcutaneous method is performed as follows:* If possible, the cervix must be fully dilated; the urethra and bladder are to be held to one side with a sound. The initial incision must be made a little above the subpubic arch and under the elevated clitoris. The left index-finger is introduced within the vagina and held against the posterior aspect of the joint. A narrow tenotomy knife is then passed up to a point within half an inch of the summit of the joint beneath the overlying soft tissues. A probe-pointed bistoury is then substituted for the tenotome and carried to the top of the joint, where it meets the index-finger. It is then carried downward through the joint until the latter is felt by the index-finger behind to give way. An assistant now presses a small gauze compress against the incision beneath the clitoris. If possible, the child is then delivered with the forceps. When pressure is made upon the pubic bones, the bladder must be held to one side. A small piece of gauze is next forced into the wound while another strip is left in the cervix. The operator must refrain from immediate repair of the cervix or perineum if the latter is torn. A soft-rubber retention catheter is left in the bladder until the power of voluntary micturition returns. The vulva is dressed with gauze and the pelvis strapped with adhesive strips. All the gauze is removed in thirty-six hours and the vulva and vagina are irrigated twice daily, the vulva being carefully dressed between times (Fig. 1136).

*Ayers: "The Pubic Symphysis in Parturition," "Amer. Jour. of Obstetrics and Dis. of Women and Children," July, 1897.

XIV. EMBRYOTOMY IN GENERAL.

Much ambiguity has arisen from the defective terminology of the mutilating operations. There is not a word in general use to designate collectively all these forms of intervention. Embryulcia, a word possessing this general significance, is used by a few only. Embryotomy, which literally means mutilation of any portion of the fetus, does not, with most authors, include operations upon the skull, which are comprised indifferently under the terms craniotomy and perforation. In this narrow sense embryotomy comprises the operations of decapitation, cleidotomy, eventration, amputation, etc. The absence of a general designation to include all these operations has led to the omission by many writers of a general section upon embryotomy in the wider sense—its indications, frequency, prognosis, etc.

Definition.—Embryotomy comprises all operations upon the fetus which have for their object a sufficient reduction in size to make extraction possible by the natural passages.

Varieties.—Embryotomy includes all degrees of mutilation, from simple acts like cleidotomy and rachidotomy to complete morcellation of the fetus. It is performed upon both the dead and the living child, and by reason of the feticide involved in the latter case, the indications naturally diverge widely according to the state of the child and the point of view of the operator, since feticide is justifiable only when the mother's life would otherwise be sacrificed.

Embryotomy in general, irrespective of the state of the fetus, comprises the following operations: (1) Perforation of the skull. (2) Perforation of the spine, or rachidotomy. (3) Crushing or comminution of the bones of the skull—cranioclasis, cephalotripsy, basiotripsy. (4) Separation of the fetal head from the body—decapitation. (5) Opening of the thoracic and abdominal cavities, and removing the whole or a part of their contents—evisceration. (6) Amputation of extremities. (7) Division of one or both clavicles—cleidotomy. (8) Division of the spine, or spondylotomy.

Frequency.—Embryotomy is the oldest of all the methods of intervention in difficult labors. Version, known during the classic period, subsequently became a lost art until revived in the sixteenth century. With the gradual introduction of version and the forceps the field of embryotomy became much restricted, and it came to be regarded almost as a resource of the unskilful. Early in the nineteenth century a few obstetricians expressed themselves in favor of doing away entirely with the operation as having no legitimate field. Nevertheless it holds a secure position to-day as regards its employment upon the dead fetus. The explanation of its permanency is found it its comparative innocuousness. Whereas the maternal mortality was once very high, it is at present the reverse. The reasons for this are to be found in improvement in fixing the indications, a proper technique, and asepsis and antisepsis. During the past fifteen years I have had exceptional opportunities to test every variety of embryotomy upon the *dead* fetus in the Bellevue Hospital maternity service. To this service are brought every year cases of neglected prolapsed cord, impacted shoulder presentation, hydrocephalus, persistent occipito-posterior positions, persistent mento-posterior positions, monsters, eclampsia, and pelvic contraction, which have been abandoned by midwives and physicians. It is from this extended clinical experience in the operating room, and not from laboratory or theoretical deductions, that I can speak of the comparative innocuousness of embryotomy, when properly performed and when the pelvis is not absolutely contracted. In the forties it was customary at the Dublin Rotunda Hospital to end about

one labor in 100 by embryotomy. In hospital practice in Germany in the seventies and eighties there was one embryotomy in every 300 to 500 labors; while in private practice the proportion was about 1:1500. In 2200 hospital cases of confinement I find a record of six embryotomies. The indications were as follows: Deformed pelves, 2; hydrocephalus, 2; albuminuria, 1; epilepsy, 1. All the operations were examples of craniotomy. The maternal mortality was 0 per cent.

Indications.—Embryotomy is indicated to-day in but two conditions. First, in all instances in which the fetus is *dead* and delivery of the unmutilated fetus would increase the danger for the mother. Second, upon the *living* fetus in obstructed labor due to monstrosity; and in exceptional cases in which the mother's condition, from hemorrhage, repeated attempts at delivery, sepsis, or shock, is such as to render embryotomy by far the safer operation.

Although modern obstetrics demands that embryotomy upon the living fetus shall, with the two above exceptions, never be performed, still two circumstances may greatly embarrass the physician in the performance of what is clearly his duty. One is the refusal of the mother and her family to accept Cæsarean section in the presence of the relative indication, and the other is the varied conditions of environment under which the physician and patient are often placed. In the city or town a physician can refuse to perform embryotomy upon a living fetus, as there are always competent practitioners at hand to whom the case can be transferred. In the sparsely settled country districts the physician is occasionally brought face to face with an obstetric complication which demands an immediate operation in order to save the mother's life. I know of several such cases. One was in the mountains of northern New York, in which, during a three-day blizzard, a physician was unable to secure assistance in a case of maternal dystocia from a generally contracted pelvis, and was compelled to do an embryotomy to save the life of the mother. Who can say that embryotomy under such circumstances was criminal? This same case was subsequently, in her second pregnancy, sent to me in New York, and I delivered her of a living child. Some practitioners who repudiate the operation of embryotomy propose that one shall wait for the fetus to die from birth-pressure, in order that the operation can be performed without compunction. This is a hazardous and possibly a fatal concession. For therapeutic feticide see page 888.

Embryotomy upon the Dead Fetus.—Embryotomy upon the dead fetus is demanded when, the absolute indication for Cæsarean section being absent, the extraction of the fetus, undiminished in size, would increase the dangers to the mother.

1. This indication includes moderate degrees of pelvic contraction, malpresentations and malpositions, deformities of the fetus, and slight obstruction in the soft parts.

2. In markedly contracted pelves, with a transverse diameter at the inlet of at least 3 inches and a true conjugate but little under $2\frac{5}{8}$ inches, embryotomy will be indicated.

3. In instances in which the conjugata vera is much under $2\frac{5}{8}$ inches, when labor is obstructed by a fixed pelvic tumor, an extensive exostosis, or an advanced cancer of the cervix, celiotomy is to be preferred, whether the fetus is dead or alive.

4. When the mother's condition demands rapid delivery, and the absolute indication for Cæsarean section is absent.

Embryotomy upon the Living Fetus.—1. Embryotomy upon the living fetus

is indicated during labor in certain rare instances, when the condition of the mother, as shown by the temperature, pulse, dangerous thinning of the lower uterine segment, whether from repeated unsuccessful attempts at delivery or from prolonged labor, would render embryotomy by far the safer operation.

2. In obstructed labor due to monstrosities.

XV. PERFORATION.

Definition.—Perforation consists in opening the fetal skull, incising the meninges and brain in various directions, and removing the latter by irrigation. Perforation of the fetal pelvis through the anus is occasionally performed.

Indications.—(See Embryotomy, page 942.)

Operation.—In most cases, if only for ethical reasons, an anesthetic should be given. The patient should, of course, not be allowed to see the child. The bladder and rectum should be emptied and the vagina properly cleansed with lysol or creolin. The patient should be in the lithotomy position with the hips drawn well over the edge of a table. The operator should now make a careful

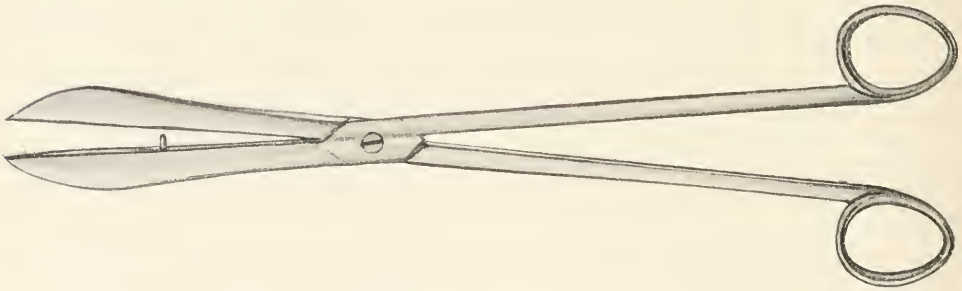


Fig. 1137.—Smellie's Scissors Perforator.

examination in order to confirm the necessity for the operation. Three types of perforator are in use: namely, the scissors (Fig. 1137); the screw with the hidden knife; and the trephine perforator. In an emergency almost any cutting instrument can be used; thus, twice in consultation I have opened the skull without a classical perforator, once using an ordinary pair of scissors, and again a scalpel. Before perforating, especially in high positions of the presenting part, the head should be firmly fixed. This is done either by suprapubic pressure or by fixation with a strong volsella forceps. I prefer the latter (Fig. 1139). A principle in perforation too often neglected and misrepresented in many works on obstetrics is the proper location of the opening into the skull. Our aim should always be so to locate this opening that subsequent traction with the cranioclast (craniotraction) will imitate the natural mechanism of labor. I have records of a number of cases in which craniotraction has been made with the cranioclast applied over the forehead and face in vertex presentation, thus extending the head and causing impaction even after perforation; and over the forehead and sinciput in face presentation, thus flexing a greater diameter into the birth canal; and over the occiput in head-last cases, producing the same result. In all instances care must be taken to introduce the perforator deep enough into the skull thoroughly to break up the base of the brain and the medulla, for possibly a mistaken diagnosis may result in the extraction of a mutilated child

making attempts at respiration, than which no greater horror exists in midwifery. The fetal scalp being seized by a volsella forceps and the head drawn downward into the pelvis as far as possible, an assistant grasps the head through the abdominal walls and fixes it in the pelvic inlet. The fingers of the left hand are carried up behind the symphysis and their palmar surfaces guide the introduction and subsequent movements of the perforator, which is inserted with the right hand and carried slowly and cautiously by a twisting or boring movement through the fetal skull. A suture or fontanelle may be utilized, but it is better, except in simple cases, to make the opening in one of the cranial bones, since in the latter case it is not so likely to become closed and difficult to find again. Every care should be taken that the instrument does not slip and bury itself in the maternal tissues. After the perforator has entered the skull as far as the shoulders of the instrument it should be twisted about several times in order to enlarge the opening. The blades may also be separated in different directions for the same purpose. It is then carried into the skull and twisted in every direction in order to break up the brain and facilitate its removal. If the trephine perforator is used, it is held against the skull by the fingers of the left hand, the right hand steadying the shank of the instrument. The crank is turned by an assistant. Whatever instrument is used, care should be taken to remove with the forceps all spiculæ of bone, and the scalp should, if possible, be made to cover the edges of the opening in order to protect the maternal tissues. The cranial contents are then washed out as far as possible by means of a flexible tube or catheter attached to a syringe. The ordinary fountain syringe will be found useful. An antiseptic solution should be used, and in the case of a putrid fetus the vagina should be frequently douched during the whole operation. If perfor-

FIG. 1138.—PERFORATION OF THE AFTER-COMING HEAD.

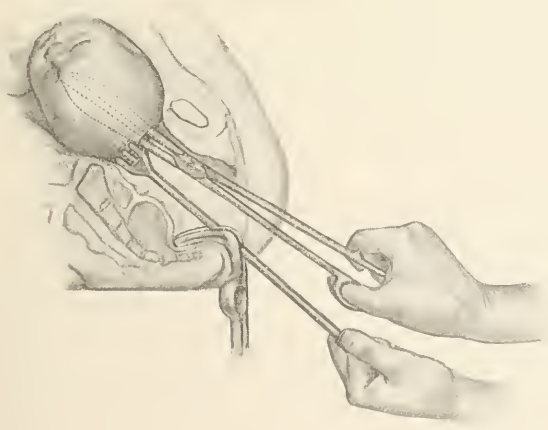


FIG. 1139.—PERFORATION OF THE FETAL SKULL.

ation and evacuation of the cranial contents do not reduce the size of the fetal head sufficiently to permit safe delivery, it may be necessary to resort to the additional operation of cranioclasm or craniotripsy (pages 947 and 951).

Pelvic Presentation.—Perforation may occasionally, in contracted pelves and with monsters, be applied with advantage to the breech if it fails to descend, and traction with the forceps, fillet, blunt hook, or upon a prolapsed leg is impossible or dangerous. An opening is made by way of the anus through the fetal pelvis and the abdominal contents are "churned up" and removed by irrigation (Fig. 1147).

After-coming Head (Fig. 1146).—Three sites for perforation are proposed by different authorities, namely, the posterior lateral fontanelle behind the ear, the occipital bone, and the floor and roof of the mouth through the hard palate. Many lives have been sacrificed by unskilful and prolonged attempts to perforate and extract after opening the brain in the first two localities, since extension of the head results, and the obstruction is often thus increased instead of diminished. In most cases the after-coming head should be perforated through the floor and roof of the mouth, then through the hard palate into the brain. The head can then be extracted by flexing it. In those very rare cases in which the chin rides up over the symphysis and cannot be gotten at, the head must be delivered by extension after perforation through the occipital bone.

Vertex Presentation (Figs. 1143, 1145).—Both in occipito-anterior and -posterior positions it is best to perforate toward the occipital end of the head-lever, so that subsequent traction will flex rather than extend the head. If cutting instruments are used, I have found that it makes little difference whether a suture, fontanelle, or solid bone is selected for perforation; if the trephine is used, a bone, preferably the posterior portion of a parietal, is selected.

Bregma Presentation.—It is best to return the head to its natural condition of flexion, or if this is impossible to perforate as near the occipital bone as possible (Fig. 1143).

Brow Presentation.—If the brow cannot be converted into a vertex and perforated accordingly, it should, if possible, be changed into a face. If impaction persists, the perforation should be made at the junction of the nasal and frontal bones.

Face Presentation (Fig. 1144).—Perforation at the root of the nose through the frontal bone gives the best results for subsequent craniotraction.

XVI. RACHIDOTOMY.

This operation consists in making a slight opening in the vertebral canal. The operation was proposed by Van Heuvel in 1848, but was not carried out until twenty years later by Tarnier. Rachidotomy is employed only when a hydrocephalic fetus presents by the breech with retention of the head. The operation has been used to some extent by Tarnier and his pupils. Failure can occur only through a disorganized state of the spinal column as a result of excessive traction.

Technique.—An incision is made down to the middle of the vertebral column. A sound provided with a mandril is then forced through the vertebræ and thrust into the spinal canal from below upward till it reaches the cranial cavity, when the liquid is allowed to drain away.

XVII. CRANIOCLASIS. CRANIOTRACTION.

Definition.—Cranioclasis signifies the crushing or comminuting of the bones of the skull within the scalp and without removing them. The operation is performed with an instrument known as a cranioclast, of which Karl Braun's is to-day the most perfect type. Others are Kehrer's, Simpson's, and Auvard's. The cranioclast is not only a crusher but a tractor; thus, when the fetal skull is securely seized by the two blades of the instrument it serves as a most convenient handle to extract the head and fetal body. To-day perforation and cranioclasis are usually immediately followed by extraction, with the cranioclast as a tractor. The procedure then becomes craniotraction.

Indications.—(See Embryotomy, page 942.)

Necessary Conditions.—(1) The pelvis must not be so greatly contracted that the fetal trunk cannot pass. A true conjugate of over 2½ inches (6.5 cm.) is necessary at full term. I believe it is generally conceded that cranioclasis and extraction through a pelvis represented by a conjugata vera of 2½ inches (6.5 cm.) or under is equally as dangerous as Cæsarean section. (2) In difficult

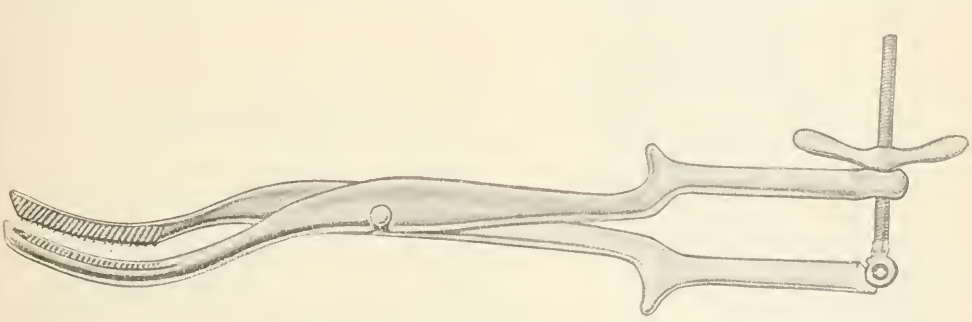


Fig. 1140.—Braun's Cranioclast.

trunk extractions the operator should never neglect to do, in addition, a cleidotomy—an operation much neglected in these cases.

Operation.—Instruments.—The original cranioclast, the device of Sir James Y. Simpson, was an evolution of the ancient craniotomy forceps and was intended by him to replace the cephalotribe. (See page 947.) It was proposed with this instrument, the solid blade of which was introduced into the perforated skull and the fenestrated blade upon the anterior portion of the skull, to wrench off the bones of the calvarium, different portions being successively seized, and subsequently to use the instrument as a tractor to deliver the remainder of the skull. Braun's cranioclast is intended to act primarily as a tractor and never as a bone forceps to break up and remove the vault of the skull. The instrument as supplied to-day by the makers consists of an exaggerated bone forceps made entirely of metal with a cephalic curve to the blades and the shanks and handle so long that the lock is outside the vulva even when the instrument is introduced high up (Fig. 1140). A hand-screw at the end of the handles aids compression. The blades, as in the Simpson's cranioclast, consist of a larger or outer blade, fenestrated and grooved, which goes on the outer surface of the head over the scalp, and a smaller or inner blade, solid and supplied with ridges which fit into the grooves upon the opposite or outer blade. Although Braun's cranioclast primarily was intended as a tractor alone, still I have found it most valuable as a comminuter of the bones of the calvarium by applying the instrument successively

over different portions of the perforated skull and crushing the bones underneath the scalp without attempting to remove the fragments, but bringing all away when the instrument is used as a tractor. The term "cranioclast" as applied to the Braun instrument is a misnomer, and the term "craniotractor," as proposed by Mundé, of New York, as a substitute for "cranioclast," is more accurate.

Application.—The application of the cranioclast is not difficult. Unfortunately, for some reason the instrument is always made for application upon the right side of the pelvis, and for proper application upon the left side—the most frequent operation—the instrument must be reversed, with the button-lock downward. This has caused much confusion to the novice and beginner, and many applications of the instrument over the face, when a vertex application would have rendered the extraction much easier. After perforation and the washing away of the brain, if the head is movable the scalp is seized with strong volsella forceps and held by an assistant. The operator then introduces two fingers of the left hand to the margin of the opening in the fetal skull, and with the right hand he grasps the inner or

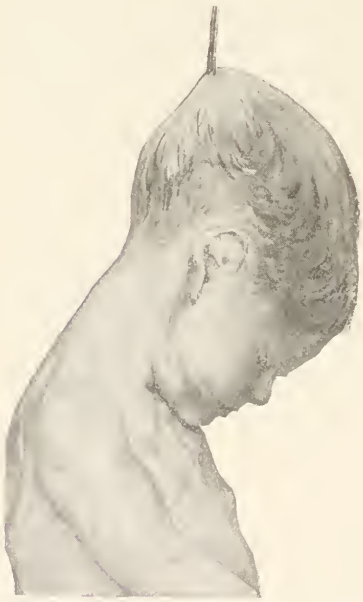


Fig. 1141.—Elongation of the Head after Perforation and the Use of the Cranioclast.—(*Author's case.*)

Fig. 1142.—Depression in the Right Parietal Bone, Caused by Extraction with Braun's Cranioclast.—(*Author's collection of fetal skulls.*)

solid blade of the cranioclast like the blade of a forceps and introduces it along the fingers of the left hand as a guide into the opening in the skull. The handle is then held by an assistant. Now if the portion to be seized is along the left side of the pelvis, the outer or fenestrated blade is seized like the blade of a forceps with the left hand, the right hand is passed into the vagina, and the fenestrated blade is then introduced along the fingers of the right hand between the fetal skull and the wall of the parturient canal, care being taken not to include the cervix, an accident of not rare occurrence. In application in the left half of the pelvis the fenestrated blade must be introduced under the solid blade, so that the lock looks downward. The handles are now taken one in each hand and the lock is adjusted and compression is made with the screw on the handle, care being taken that none of the maternal parts are included in the instrument and that the solid blade is well sunken in the cavity of the skull. Rotation of the presenting part with the cranioclast is a subject still in dispute.

A twisting corkscrew-like motion with the instrument, as recommended by some operators, I have found unnecessary and dangerous, since spiculæ of bone do occasionally in difficult cases perforate the skull, and these readily lacerate the adjacent maternal soft parts, and the operator is not always able to detect these perforations of the scalp. Rotation with the instrument, however, in order to bring the vertex or chin anteriorly is permissible and advisable, as in forceps operations. In ordinary cases reapplication of the instrument and comminution of the bones will not be found necessary. Traction is now cautiously made in the axis of that portion of the pelvis in which the head or breech lies, and if no slipping of the instrument occurs, the amount of traction is gradually increased so as to cause the perforated skull to mold itself to the shape of the pelvis, and to bring the cranioclast away from the side of the parturient tract into the middle of the pelvis.

Left Vertex Positions.—The cranioclast should be applied so as to include the occipital bone (Fig. 1143).

Right Vertex Positions.—As in left positions, the best result is obtained by application over the occipital bone.

Bregma Presentation.—The best results are obtained by grasping the occipital end of the head-lever and if necessary rotating the occiput with the cranioclast to the front of the pelvic outlet (Fig. 1143).

Brow Presentation.—If the brow cannot be converted into a vertex, the cranioclast is applied as in face presentation (Fig. 1144).

Face Presentation.—The solid blade is passed into the skull through an opening in the frontal bone at the root of the nose, and the fenestrated blade is made to include the lower jaw (Fig. 1144). The other two sites of application—namely, the sides of the head and the occipital region—are always, if possible, to be avoided. (See Perforation, page 944.)

After-coming Head.—Application of the solid blade through a perforation passing up through the floor and roof of the mouth (hard palate) and the fenestrated blade over the face will give the best prognosis, as flexion of the head is thereby insured (Fig. 1146). In exceptional cases in which the chin rides up over the symphysis, the occipital application and delivery of the head by extension may become necessary.

Breech Presentation.—The solid blade is passed into the anus and the fenestrated blade is applied over the sacrum (Fig. 1147).

Persistent or Permanent Occipito-posterior Position (Fig. 1145).—Our aim should be to secure a firm hold with the instrument over the occipital bone in order to exaggerate, if possible, the existing flexion of the head. The solid blade enters the skull at or near the small fontanelle, and the fenestrated blade, if possible, is adjusted over the center of the occipital bone, which latter, of course, is in the hollow of the sacrum. In difficult cases an application made to the side of the head over a limb of the lambdoidal suture will be found necessary on account of the difficulty in applying the instrument in the sacral hollow over a tightly fitting head. Less injury to the maternal soft parts will result if we can gradually with our downward traction rotate the occiput into an anterior position. This rotation of the head with the cranioclast is, under such circumstances, not only justifiable but advisable, as by so doing a mechanism of labor much more favorable for the maternal prognosis is obtained. Great caution should be exercised, should it be found necessary, after failure of anterior rotation, to deliver with the occiput to the rear. This with full-sized heads should never be attempted until after the head has been well elongated with the cranioclast, and, if thought necessary, comminuted as well (Fig. 1141).

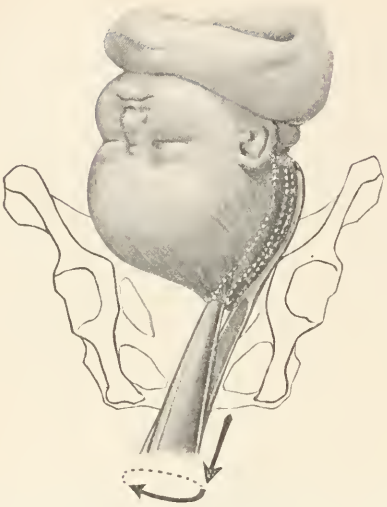


FIG. 1143.—APPLICATION AND USE OF THE CRANIOCLAST IN A LEFT OCCIPITO-POSTERIOR POSITION OF THE VERTEX.

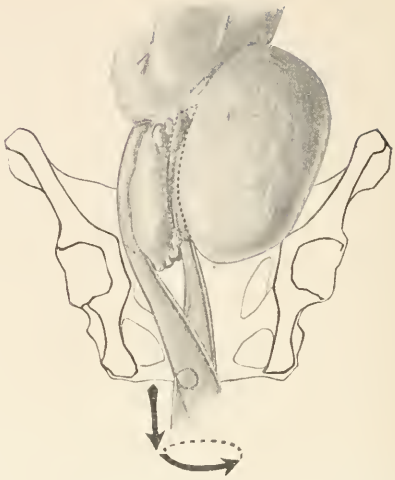


FIG. 1144.—APPLICATION AND USE OF THE CRANIOCLAST IN A RIGHT MENTO-POSTERIOR POSITION OF THE FACE.

FIG. 1145.—APPLICATION AND USE OF THE CRANIOCLAST IN A PERSISTENT OCCIPITO-POSTERIOR POSITION.

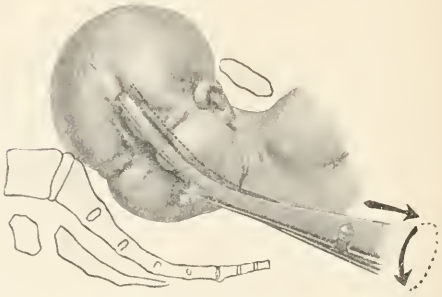


FIG. 1146.—APPLICATION AND USE OF THE CRANIOCLAST IN CASE OF AN AFTER-COMING HEAD.

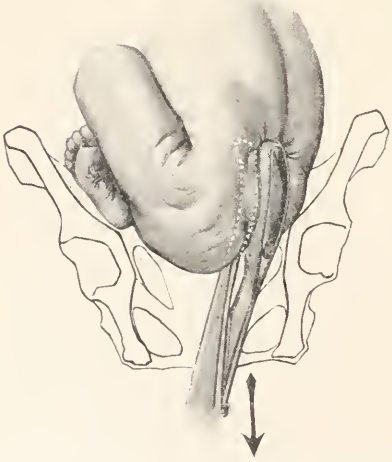


FIG. 1147.—CRANIOCLAST APPLIED TO THE BREECH, IN LEFT SACRO-ANTERIOR POSITION.

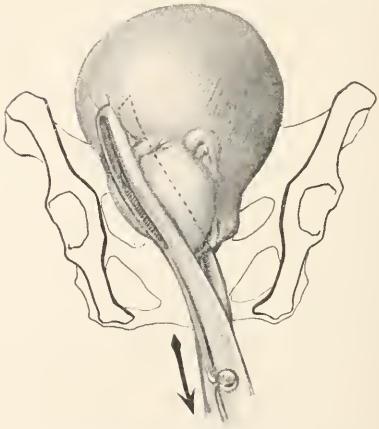


FIG. 1148.—APPLICATION OF THE CRANIOCLAST TO THE DECAPITATED HEAD IN UTERO.

Persistent Mento-posterior Position (Fig. 1144).—No matter how great the temptation to apply the cranioclast over the forehead, this should always be avoided in face presentation, and the instrument applied to the chin end of the presenting lever. This can be accomplished by passing the solid blade into an opening at the root of the nose, and applying the fenestrated blade so as to include the lower jaw (Fig. 1144). This, as in permanent occipito-posterior position, necessitates the adjustment of the fenestrated blade in the hollow of the sacrum, a manœuver sometimes attended with much difficulty. Under such circumstances a compromise may be made by adjusting the outer blade at the posterior extremity of an oblique diameter of the pelvis, and over a lateral angle of the jaw.

As already hinted at under "Perforation," the great principle in cranioclasis or craniotraction is so to apply the instrument and so to make traction that the normal mechanism of labor shall be imitated as closely as possible. In other words, traction should be made so that the portion of the presenting part which is naturally lowest under normal conditions shall be kept lowest in the pelvis and delivered first, as in spontaneous delivery. This principle is often, if not always, lost sight of; and because, as is well known, a firmer hold with the instrument can be secured over the facial bones, or over the side of the skull over an ear, some operators persist in using only these two localities, with an entire disregard of the mechanism of labor, thus giving rise to serious, and, as I have seen, fatal complications

XVIII. CEPHALOTRIPSY.

Definition.—Cephalotripsy is the crushing of the presenting part by an instrument resembling the obstetric forceps. In 1829 Baudelocque* invented an instrument patterned somewhat after the obstetric forceps, which he designed for crushing the fetal head by grasping it in the same manner as does the obstetric forceps, and without previous perforation to force the brain from the mouth,

Fig. 1149.—Cephalotribe Applied at the Sides of the Head. Side View.

orbits, and nose, crushing the cranial bones within an intact scalp, and thus preventing edges of fractured bones from doing injury to the maternal soft parts. In the early years of its use the cephalotribe was intended to abolish the perforator, the craniotomy (bone) forceps, and the crotchet. The cephalotribe was originally intended only to crush the skull, just as the cranioclast is to-day really an instrument designed for traction. To-day the cephalotribe is used both as a crusher and a tractor.

*A. Baudelocque: "Revue Méd.," August, 1829, p. 321.

Indications.—All forms of cephalotribe, but especially the broad-bladed type, are useful to compress the head after perforation before it becomes fixed at the brim. As a tractor after perforation in the lesser degrees of obstructed labor it is also most valuable. A limit for the safe employment of the cephalotribe exists, however—namely, in pelvic contraction when the clinical index of the pelvis is represented by a conjugata vera of three inches the safe limit is reached. Much depends, moreover, upon the size of the fetal head and the resiliency of the cranial bones. To-day the use of the cephalotribe is mainly limited to a crushing of the head or breech before the application of the cranioclast for purposes of traction, and to crushing and extracting the base of the skull in the exceptional cases in which the cranioclast has slipped and torn away the vault of the skull. In such cases the cephalotribe is most useful to secure a firm hold on the base of the skull, to crush it, and as a tractor to extract the fetus. Practically this is the only way the cephalotribe is to-day used by most operators. Some operators still follow perforation with the application of the cephalotribe as a crusher and an extractor, but for the latter purpose the cranioclast is far superior.

FIG. 1150. — CEPHALOTRIBE APPLIED AT THE SIDES OF THE HEAD. ANTERIOR VIEW.

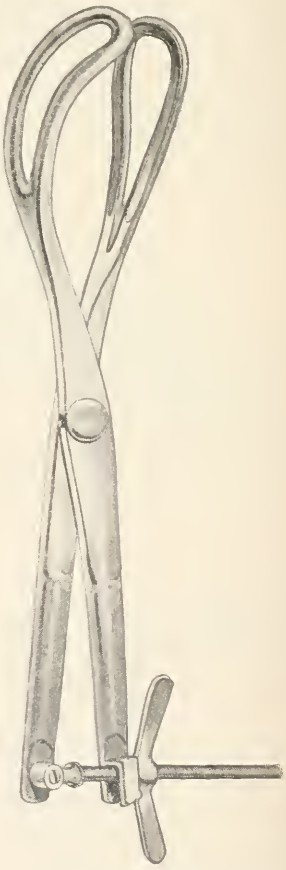


FIG. 1151. — BREISKY'S BROAD-BLADED CEPHALOTRIBE.

Cranioclast and Cephalotribe Compared.—(1) The cephalotribe is bulkier and heavier than the cranioclast and occupies more room in the pelvis than the latter instrument, a great disadvantage in contracted pelves. (2) Both blades of the cephalotribe lie outside the fetal skull, and unless the narrow-bladed instrument is used—and this is very liable to slip—they do not sink into the scalp as does the outer blade of the cranioclast. On the other hand, one blade of the cranioclast is hidden in the cranial cavity not otherwise occupied, and the outer fenestrated blade soon sinks into the scalp and thus avoids injury to the maternal soft parts. Further, after a short period of traction with the cranioclast, the instrument, if properly applied, comes to occupy the middle of the pelvis, where it can be kept with the left hand from contact with the maternal parts. (3) Traction with the cranioclast as the head is being drawn through the pelvis exerts an even pressure on all points of the circumference of the parturient tract, finally elongating the fetal head, thus diminishing all the presenting diameters, and even rendering the extraction easier as traction is continued. Extensive lacerations and injuries to the maternal soft parts are of rare occurrence after cranioclasis and

craniotraction. On the other hand, compression of the head with the cephalotribe diminishes only one diameter, the compressed one, and correspondingly increases the opposite ones—namely, those non-compressed (Figs. 1149 and 1150). As the head is being drawn through the pelvis, pressure is thus concentrated at two points of the parturient tract instead of being diffused over the entire circumference; thus preventing elongation of the head as in craniotraction, and rendering the extraction more difficult and liable to injure the maternal parts. (4) As a rule, the cranioclast takes a firmer hold of the fetal head than does the cephalotribe, but I have seen many exceptions.

Instruments.—Practically there are two types of the cephalotribe in use today—namely, the narrow or solid-bladed, and the broad or fenestrated-bladed instruments. Among the narrow or solid-bladed instruments are Blot's and Scanzoni's. Among the broad or fenestrated-bladed cephalotribes are Breisky's (Fig. 1151) and its many modifications. Olshausen's cephalotribe (Fig. 1152) is an excellent example of the narrow solid-bladed instrument, and Breisky's of the broad fenestrated. All of the former are provided with a generous pelvic curve, but the cephalic curve is absent in some, as the blades are in close apposition. In the latter type of instrument, provision is made for both a pelvic and a cephalic curve:

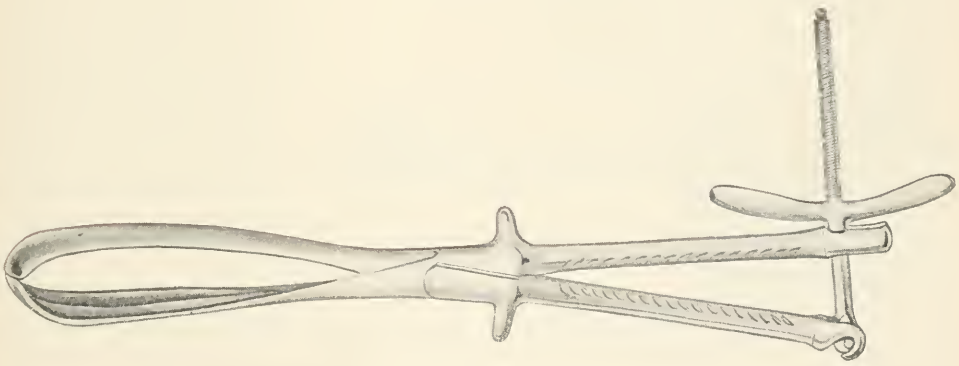


Fig. 1152.—Olshausen's Narrow-bladed Cephalotribe.

the pelvic being $3\frac{1}{4}$ inches (8.2 cm.) in extent, and the cephalic $2\frac{1}{4}$ inches (5.7 cm.), measured from the outer surfaces of the blades. A serious objection exists to each type of cephalotribe, neither of which obtains in the case of the cranioclast—namely, the narrow-bladed cephalotribes, whether they possess cephalic curves or not, are liable to slip, and the broad type occupies too much room in the pelvis, especially when the latter is contracted.

Operations.—The principles governing the application of the cephalotribe are precisely the same as in the case of forceps. Following perforation, projecting spiculæ of bone must be carefully extracted with the fingers or dressing forceps and the exact presentation and position again determined.

High Cephalotribe Operation (Fig. 1153).—When the head or breech is still free above the pelvic inlet, great care must be taken to have the presenting part firmly held at the inlet by suprapubic pressure by an assistant. Adaptation of the cephalotribe to the sides of the fetal head at the pelvic inlet is not safe, or in fact necessary. Objection has been raised to the use of the cephalotribe here, that seizing the head antero-posteriorly increases the transverse diameters to an equal extent, and that this would be particularly disadvantageous, especially in contracted pelves (Figs. 1149 and 1150). This would be

true were the head fixed transversely in the pelvis, but when the head is free it will be found in an oblique diameter, and the cephalotribe seizes the head in the opposite oblique and not in an antero-posterior diameter. Compensation of head compression thus takes place in an oblique diameter opposite to the one grasped by the instrument and not in a transverse diameter of the head. Should, by chance, the head be seized in a transverse diameter, rotation of the head with the cephalotribe into an oblique diameter can readily be accomplished. Dragging of a head or breech through the pelvic inlet with so heavy and powerful an instrument as the cephalotribe should rarely be attempted, because of the danger of pressure of the blades upon the maternal soft parts between the symphysis and sacral promontory. Should antero-posterior adaptation occur, either spontaneously or artificially, the instrument must be removed and reapplied in a transverse or an oblique diameter, or, better, the cranioclast substituted. Compression with the hand-screw should always be slow, and repeated digital explorations should be made to detect projecting spiculæ of bone.

FIG. 1153.—BROAD-BLADED CEPHALOTRIBE APPLIED IN VERTEX PRESENTATION. MEDIAN OPERATION.

FIG. 1154.—BROAD-BLADED CEPHALOTRIBE APPLIED TO THE BREECH.

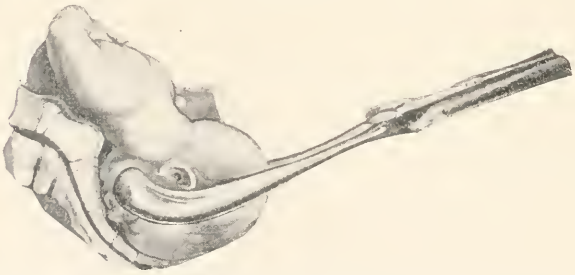


FIG. 1155.—NARROW-BLADED CEPHALOTRIBE APPLIED TO VERTEX. LOW OPERATION.

LOW CEPHALOTRIBE OPERATION. — The left or lower blade is first introduced at the extremity of the transverse or oblique pelvic diameter according to the position of the presenting part, followed by the application of the right or upper blade; great care being used not to injure the uterine or vaginal tissues. As in high operations, compression is made slowly with the hand-screw, on the lookout digitally for bone spiculæ, and during extraction the instrument is guided and the maternal parts are protected by the fingers of the left hand (Figs. 1153 and 1155).

CEPHALOTRIBE TO THE BREECH.—The same general principles apply here as in head presentations, namely, to keep the instrument in an oblique or transverse diameter of the pelvis (Fig. 1154).

After-coming Head.—Although some authorities (Lusk) do not consider perforation necessary as a preliminary, still perforation through the floor and roof of the mouth before the application of the instrument will be found to prevent many maternal injuries.

Decapitated Head.—In instances of detachment of the fetal head from the body and the retention of the former in the uterine cavity the cephalotribe will often prove of use in its extraction. The head must be steadied at the inlet with suprapubic pressure by an assistant, and I prefer to grasp the scalp or face from below with a strong volsella forceps as well, and then apply the cephalotribe to crush and extract.

Substitutes for Cranioclasis and Cephalotripsy.—Although great ingenuity has been exerted to invent other and more satisfactory substitutes for the operations of cranioclasis and cephalotripsy, still in spite of the shortcomings and defectiveness of these latter measures for diminishing the size of the fetal head and breech, most obstetric surgeons are agreed that these operations are at the present time the best we have at our command. *Craniotomy:* This was the original and now practically obsolete method of diminishing the size of the fetal skull, and brought into use various forms of craniotomy forceps. After perforation and removal of the brain, one of these bone forceps was introduced under the scalp and the parietal, occipital, and frontal bones were seized and broken away piecemeal by a twisting movement of the wrist. The operation was tedious and dangerous, for unless the maternal soft parts were carefully guarded the withdrawal of the sharp fractured bones caused dangerous lacerations. The craniotomy forceps of Meigs and Taylor, which were nothing more than heavy bone forceps, were at one time generally used in this country. Inquiry of the largest instrument-makers in New York city shows that the demand for craniotomy forceps has practically ceased. *Cephalotomy:* It has been proposed either to remove the fetal head in segments or to divide the skull into two halves. The forceps saw of Van Huevel was intended to divide the head from vertex to base into two halves* to remove from the head a triangular segment the apex of which should include the bones at the base of the skull. The wire écraseur has been applied to successive portions of the head for the purpose of crushing, as suggested by Barnes, of London.† Hubert invented a transforateur which was intended to bore through and break up the sphenoid bone, and thus diminish the resistance of the base of the skull. Instruments which combined the principles of the transforateur and the cephalotribe were invented by Valette, Hüter, and Solline, and were termed "sphenotribes." To-day I know of no operation of cephalotomy that for effectiveness and safety can successfully compete with cranioclasis. The mechanical principles involved in many of the proposed cephalotomy procedures are in the main correct, but the instruments are complicated, and some of them are too bulky to be used with advantage in cases of pelvic contraction.

XIX. DECAPITATION.

Definition.—A separation within the uterus of the fetal head from its trunk.

Indications.—Infrequently in neglected impacted shoulder presentations division of the fetal head from the body is demanded in order to break up the triangular wedge which blocks the pelvis; dividing, so to speak, the wedge in two

* "Dict. de Médecine et de Chirugie," Art. "Embryotomie," page 680.

† "Obstetric Operations," page 411.

parts, thus permitting the delivery first of the fetal body and subsequently of the head. The indications are thus almost exclusively in neglected impacted shoulder presentation, in which attempts at any form of version to correct the malpresentation would jeopardize the already dangerously thinned lower uterine segment. The pelvis must have a true conjugate of at least $2\frac{3}{4}$ inches (nearly 7 cm.), and full dilatation of the cervix must be present or secured artificially.

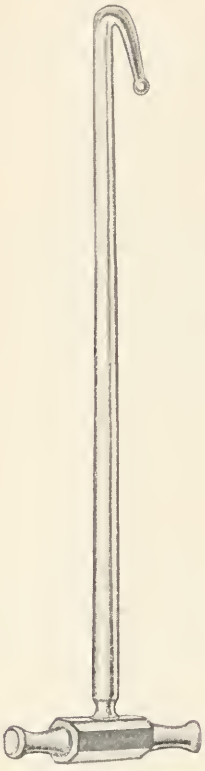


FIG. 1156.—BRAUN'S DECAPITATING HOOK.

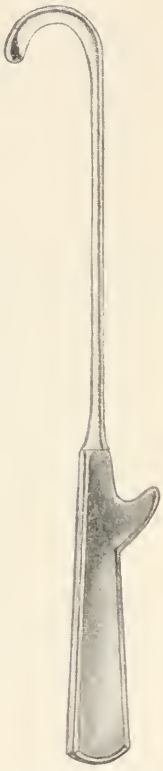


FIG. 1157.—DECAPITATING SICKLE KNIFE OF RAMSBOTHAM.

Operation.—Various forms of decapitators are in use, ranging from a simple whip-cord decapitator to most complicated and expensive embryotomes made up of many parts. All types of decapitators may be included among the following: (1) Karl Braun's blunt hook; (2) Schultze's sickle hook; (3) scissors; (4) the wire écraseur; (5) various embryotomes, notably those of Pierre Thomas and M. Tarnier; (6) the chain-saw; (7) the whip-cord. In default of special instruments, a wire or a strong cord may be passed around the fetal neck by means of an English catheter or perforated blunt hook, and by a sawing motion the neck may be divided The chain-saw of the surgeons may be adapted to the same purpose. Much difficulty is often encountered in passing the cord, chain-saw, or wire of an écraseur over the neck, and ingenious and complicated instruments have been invented to overcome the difficulty. The simplest method is to thread a piece of bobbin two feet long into the end of a No. 16 English catheter with stylet in place (Fig. 1109). A curve is next imparted to the catheter by placing it in warm water if necessary, and it is then passed around the fetal neck. An end of the bobbin is caught with two fingers

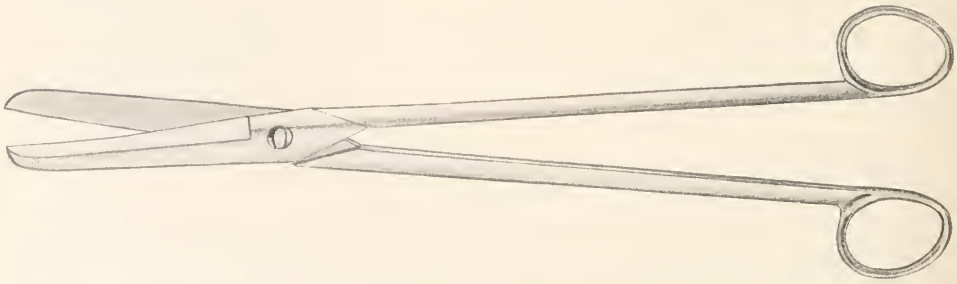


FIG. 1158.—DUBOIS'S DECAPITATING AND GENERAL EMBRYOTOMY SCISSORS.

in the vagina or with dressing forceps, and the catheter is finally withdrawn with the other end. The bobbin encircling the neck is used to drag up and around a whip-cord or the wire or chain of an écraseur. In the use of cord, wire, or chain great care must be used to protect the maternal soft parts, and to make sure that a portion of the cervix is not included in the instrument used. The choice of instruments to-day usually lies between (1) Braun's blunt hook decollator (Fig. 1156); (2) a stout pair of scissors, as Dubois's (Fig. 1158); (3) a curved knife-edge hook, as Schultze's or Ramsbotham's (Fig. 1157). Perhaps nowhere more than in obstetrics does tradition influence one in the choice of instruments and operative procedure. For this reason the blunt decapitating hook of Braun is described and recommended by each obstetric writer in turn. After many unprejudiced comparisons of the Braun hook with a strong pair of scissors and the knife-edge hook, I am unable to understand why one should prefer such an awkward and unscientific instrument as the first to either of the latter. My choice of instruments is for the scissors and sickle knife. I rarely if ever use a Braun's hook, except occasionally for demonstration. The space occupied by each of the three instruments in a narrow pelvis is about the same, the choice, if any, being in favor of the scissors.

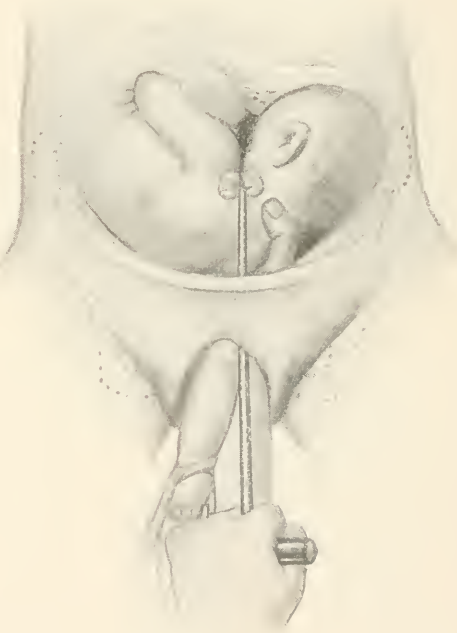


Fig. 1159.—Method of Decapitating with Braun's Decapitating Hook.

1. Braun's Blunt Hook Decollator (Figs. 1156 and 1159).—This instrument is a modified blunt hook with its end bent nearly at an acute angle, flattened somewhat from side to side, and terminating in a blunt button shaped like the end of a foil. The handle, formerly of ebony but now cast in one piece with the rest of the instrument, is set at right angles, thus imparting when grasped with the whole hand a powerful leverage movement to the hooked end. *Operation:* Every instrument should be thoroughly tested upon a piece of soft wood, such as pine kindling, before being put into use, to avoid an unexpected break and to guard against injury to the soft parts of the mother. Decapitation is usually performed in shoulder presentation, and although, so far as I am aware, no text-book mentions the fact, still I have found in practice that there is a distinct choice of hands to be used in left and right shoulder positions. In all cases if an arm is prolapsed, it is advisable to apply a sling to it and have an assistant make firm traction on it to fix the shoulder firmly in the pelvic inlet. In left shoulder positions it is advisable, if the operator has sufficient control over his left hand, to encircle the fetal neck with the fingers of the right hand, the thumb to the front of the neck, namely, in the anterior portion of the pelvic inlet, in both anterior and posterior right shoulder positions, and index and other fingers behind. The neck is then grasped firmly and with the aid

of the prolapsed arm drawn down as far as possible into the pelvis. The hook of the decollator is next carefully passed with the left hand behind the symphysis, along the right thumb of the operator as a guide, and the button end of the hook passed over the neck and received by the right index finger at the other side of the neck and in the rear of the pelvis. The handle of the instrument is now seized with the left hand and by a rotary motion of the instrument between the index finger behind and the thumb in front, thus guarding the point at all times as far as possible, the neck tissues, portion by portion, are seized by the button point and twisted off until the spinal column is divided with the same rotary motion or by direct downward traction on the remaining soft tissues of the neck. Separation of these last tissues by twisting and downward traction must not be too sudden, lest the sudden freeing of the hook penetrate the maternal soft parts. This accident may be avoided by care in the use of the hook or by substituting a pair of scissors or a sickle knife to divide the last few shreds of tissue. In right shoulder positions I have found it most convenient to reverse the position of the two hands of the operator, using the left hand to encircle the neck and the right to rotate the instrument. This is the usual position of the shoulder illustrated in the text-books, whereas the left scapulo-anterior is the most common, and the use of the operator's hands in this position is thus left to the imagination.

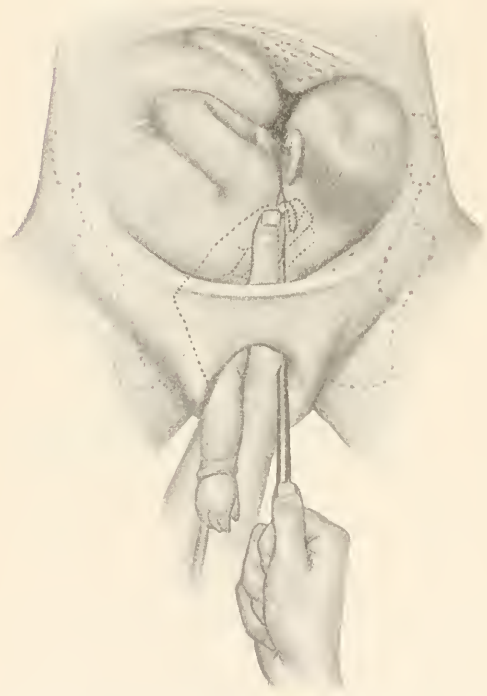


FIG. 1160.—METHOD OF DECAPITATING WITH DECAPITATING SICKLE KNIFE OF RAMSBOTHAM.

2. SICKLE-KNIFE OR CURVED-SAW DECAPITATORS.—A more convenient and safer mode of decapitation, even for the experienced operator, is a sickle knife (Figs. 1157, 1160, and 1161), or a decapitating hook with serrated edge. I am accustomed to use the scissors in conjunction with one of these instruments to the exclusion of the unscientific and awkward Braun's hook. *Operation:* Each instrument should be carefully tested before use. The shoulder should be brought as low in the pelvic inlet as possible by traction with a sling upon a prolapsed arm. In left shoulder positions we encircle the neck with the right hand and with the left carry the decapitator up in front of the neck, the point being directly toward the head when the level of the neck is reached, pass the point over the neck and palpate behind with the internal or right fingers to make sure that the instrument is properly adjusted over the fetal neck. The point being guarded with the internal hand, the decapitator is now drawn firmly downward and with a to-and-fro movement, as far as the vaginal outlet will permit, the neck is quickly cut through (Fig. 1161). A common mistake with the novice is, after the vertebræ are divided, to incline the plane of section into the

fetal body or shoulder instead of cutting through the remainder of the neck. Repeated palpation with the internal hand will prevent this error, which unnecessarily prolongs the operation. The last shreds of cervical tissue should not be too suddenly divided lest the sudden release of the decapitator lacerate the maternal soft parts. In right scapulo-positions the left fingers encircle the neck and the decapitator is used in the right hand outside of the vulva. In both right and left positions the point of the sickle knife or curved saw decapitator should be pointed to the posterior part of the pelvis to avoid injury to the bladder, and the handle during the pendulatory movement inclined as far forward as possible. We thus, by cutting downward and forward, avoid injuring the rectum.

3. Decapitation with Blunt Scissors (Figs. 1158, 1162).—Although the objection has been raised to the scissors decapitator that it is apt to wound the maternal soft parts or the operator's fingers, yet this method after a little practice

Fig 1161.—Method of Holding the Sickle-knife Decapitator.

Fig. 1162.—Decapitating with Scissors.

on the manikin will usually prove a safe and rapid one and will be selected in preference to the Braun hook or curved knife or saw methods. *Operation:* The arm is prolapsed as in the first two methods, and the choice of hands is the same. The cutting should be done from below upward, the outer surface of the blunt points being guided with the internal finger. Some difficulty may be experienced in dividing the last few shreds of tissue at the upper part of the neck, and this can be overcome by hooking the index-finger over the string of tissue, drawing it down into the vagina, and cutting along the finger as a director. All the decapitating scissors have a common fault, namely, the handles are too small, admitting only one finger into each. In active use these fingers become bruised and numb by reason of the severe pressure to which they are subjected. To overcome this objection I have had made both a straight and a curved pair of obstetric scissors with handles to admit several fingers. These scissors are powerful and

convenient, and serve equally well for decapitation, eventration, amputations of extremities, or spondylotomy.

Extraction after Decapitation.—Toward the end of the operation the fetal head should be fixed at the pelvic inlet by suprapubic pressure by an assistant (Fig. 1167). The obstructing wedge should be broken up by the complete severing of the neck, when the fetal body may be readily delivered by traction upon the prolapsed arm. The head may possibly be delivered spontaneously; it is best, however, not to wait for uncertainty, but to pass the hand up and manually deliver at once. (1) The stump of the vertebral column should be palpated for sharp projecting vertebræ, and if, as usually happens, none are present, two fingers are passed into the mouth and the thumb over the base of the skull for counter-pressure and the head is delivered manually in a face presentation (Fig. 1163). (2) If much resistance is met with, the blunt hook or a crotchet, if one is at hand, may be substituted for the fingers in the mouth. (3) If a sharp projecting vertebral stump exists, extraction in face presentation may dangerously lacerate the maternal soft parts. It is then better either to extract the head vertex first with the forceps, or to perforate the vertex and extract with a cranioclast (Fig. 1148), or with two fingers wrapped with aseptic gauze and passed into the opening in the skull, and the thumb over the occipital bone for counter-pressure. The gauze is to protect the fingers from laceration by the cranial bones. (4) In contracted pelves, perforation and extraction with the cranioclast or cephalotribe should be the method of election (Fig. 1148).

FIG. 1163.—MANUAL EXTRACTION OF THE DECAPITATED HEAD.

XX. EXENTERATION OR EVISCERATION.

By this is meant the opening of the thorax or abdomen, or of both, and the removal of their contents.

Indications.—The most common indication is in case of shoulder presentation in which decapitation fails or is impossible, especially when the head and neck are so high above the pelvic inlet as to be difficult to reach. Evisceration is occasionally demanded in cases of monsters after perforation, extraction of the head, and cleidotomy, and of fetal tumors, as cystic kidney, ascites, or distended bladder.

Operations.—The opening into the abdomen or thorax can be made with any of the perforators, or with a straight or curved pair of Dubois scissors, whichever is most convenient. No matter what instrument is used, the maternal parts must be carefully guarded from injury; and if the part to be perforated is at all movable, it should be firmly grasped with stout volsella forceps and fixed at the inlet by suprapubic pressure. When the chest is entered, it is advisable to secure

an ample and permanent opening either by enlarging the original opening made with the perforator by turning the instrument so as to make a second incision at right angles to the first, or, better still, by cutting away several segments of ribs with the heavy Dubois scissors. The viscera are removed with strong volsella forceps, first breaking them up, if necessary, with the perforator or scissors. In shoulder presentation the abdominal cavity may be reached directly from the thorax by perforating the diaphragm, and, again, in difficult breech extractions the thorax can be opened from the abdomen by the same route. After evisceration in impacted shoulder presentation the simplest method of delivery should be chosen. (1) Usually the reduced bulk of the fetus renders it easy and safe to pass up the appropriate hand, seize the feet or head, and do an ordinary podalic version without injury to the distended uterine segment or cervix, thus imitating nature's method of spontaneous version. (2) Should difficulty be experienced, a further operation of disjointing the spine with the Dubois scissors in the dorsal region may be performed, and, the fetus being divided in halves, each half is separately delivered. (3) In cases of macerated or small fetuses it will not be necessary to divide the spine, but with a blunt hook the fetus may be doubled upon itself and delivered in imitation of nature's method in spontaneous evolution. This method of delivery is facilitated by prolapse of an arm, for then traction can be made upon both blunt hook and prolapsed arm at one and the same time. Extraction after mutilation of the fetal soft parts requires no special technique, as the reduction in size is supposed to be so thorough that general principles will suffice.

XXI. AMPUTATION OF EXTREMITIES.

Only rarely is the obstetrician called upon to amputate an extremity or several extremities. Possibly it may be demanded in cases of fetal monstrosities and impaction of multiple presentations (page 558). The amputation is best performed with the curved obstetric scissors.

XXII. CLEIDOTOMY.

Cleidotomy or division of both clavicles is an obstetric operation which has for its object the diminution of the bisacromial diameter of the dead fetus, when the shoulders obstruct its passage. This simple operation, rarely mentioned in the text-books, has never, I believe, taken its proper place in obstetric surgery, as a means of lessening maternal morbidity and mortality. How often we hear of instances in which, after perforation and extraction of the fetal head in the case of a generally contracted pelvis or outlet, or an excessively large child, twenty minutes or more were spent in extraction of first one and then the other shoulder, thereby adding perhaps to the already existing shock! As a matter of routine in these cases I am accustomed to divide the clavicles, and it is amazing how the diminution of the bisacromial diameter thus produced renders the subsequent extraction of the fetal shoulders a comparatively easy task. In a number of instances at the Emergency Hospital, in which birth of the head had been accomplished by forceps or perforation and craniotraction, the shoulders resisting all ordinary methods of extraction, the simple operation of cleidotomy completely changed the clinical picture. From measurements taken at the bedside, and from experi-

ments upon fetal cadavers, I have found that the bisacromial diameter is in cleidotomy readily reduced from 5 inches (12.7 cm.) to $3\frac{1}{2}$ inches (8.89 cm.). Figs. 1165 and 1166 show a fetal cadaver, photographed on the same scale before and after cleidotomy.

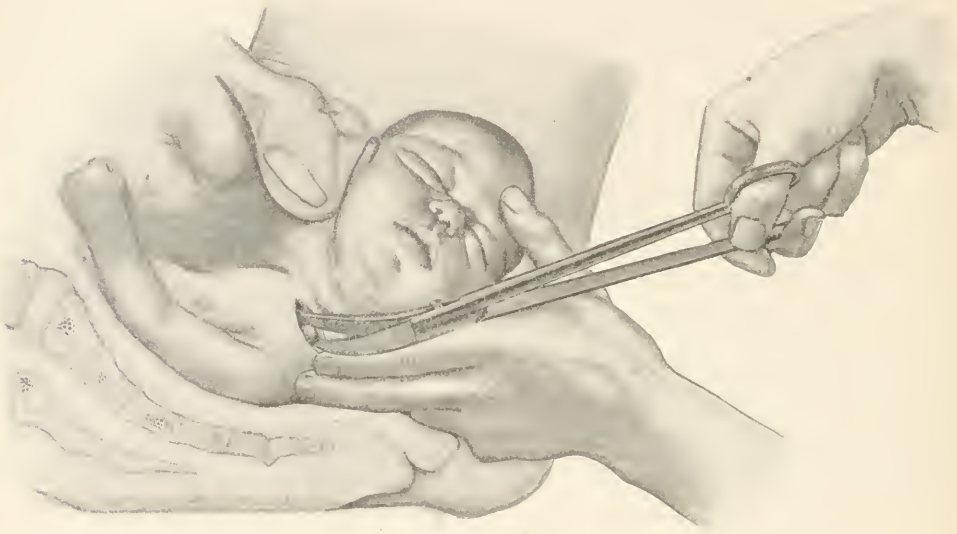


FIG. 1164.—THE OPERATION OF CLEIDOTOMY, PERFORMED WITH LONG CURVED SCISSORS.

FIG. 1165.—FETAL CADAVER BEFORE CLEIDOTOMY.

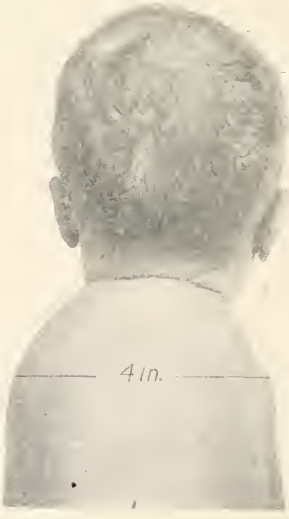


FIG. 1166.—FETAL CADAVER AFTER CLEIDOTOMY.

Operation.—This is best performed with the curved obstetric scissors (Fig. 1158), two fingers of the left hand being used to guide the blunt points to the middle of each clavicle. It will usually be necessary to extend or flex laterally the fetal head strongly so as to give room for the use of the scissors. (Fig. 1164.)

XXIII. SPONDYLOTOMY.

Spondylotomy is an operation for dividing the spinal column of the fetus very much as it is divided in decapitation, and has been recommended * as an alternative for the latter operation. The operation as well as the subsequent extraction requires more time and is more difficult than decapitation.

(C) OPERATIONS FOR DELIVERY.

I. EXPRESSION OF THE FETUS. EXPRESSIO FOETUS. (Fig. 1167.)

Definition.—Expression of the fetus is the term applied to the method of delivery of the child by the exertion of pressure upon the fundus of the uterus. It

FIG. 1167.—EXPRESSION OF THE FETUS. EXPRESSIO FŒTUS.—(*From a photograph taken at the Emergency Hospital.*)

acts by increasing the intra-abdominal pressure and stimulating the uterine muscle to contraction. In one form or another this principle has been employed from the earliest times by people of all nations, civilized and barbarous.

* Professor A. R. Simpson, of Edinburgh.

Indications.—Some hold that this method may complete delivery in the entire absence of pains, but it is usually adopted only as a means of increasing the duration and strength of the normal uterine contractions. In this way it is used at the end of the second stage when the uterine contractions lack force and the external genitals are not too tense and narrow. With a small fetus it may be of great value when there is an indication for immediate delivery. In such a case expression may complete the expulsion of the fetus more rapidly than any other procedure. When pains have been weakened by anesthesia and the fetus is in danger it is of value. A further indication results from failure of the head to engage in the brim of the pelvis, although the uterus is contracting strongly and no disproportion between the size of the head and that of the inlet exists. Such a condition is present when a pendulous abdomen permits a marked anteversion or anteflexion of the uterus. The same result may occur from the presence of a maternal umbilical or ventral hernia. Under these circumstances properly applied pressure upon the abdominal wall will cause the head to enter the brim and, assisted by the natural expulsive force of the uterus, it will advance rapidly. In delivery of the second twin, expression is sometimes of assistance, but great care must be exercised that the uterus is not emptied too suddenly.

Contraindications.—The presence of a large amount of fat in the abdominal wall interferes seriously with the manœuver. Marked tenderness and tonic contraction of the uterus are absolute contraindications. If inflammatory conditions of the adnexa are present, external pressure may lead to dangerous results. Disproportion between the size of the fetus and of the parturient canal, whether from narrowing of the pelvis or rigidity of the soft parts or other cause, should prevent its employment.

Operation.—The woman is placed in the dorsal position, close to the edge of the bed or upon a table. Anesthesia is of value in some cases, but in others it is not desirable, as it diminishes the natural uterine contractions. The operator, standing at the right side, grasps the fundus between the two hands and exerts pressure upon the uterus in the axis of the inlet (Fig. 1167). This is done only during the uterine contractions, beginning gently and gradually increasing the amount of force employed. During the interval between the pains the uterus may be gently massaged. Care must, of course, be exercised, as in the Credé method of placental expulsion, that no injury is done to the appendages by the use of undue force improperly applied. Even when the method is adopted in cases in which there are no natural uterine contractions, intermittent pressure alone should be used, imitating, as far as possible, the normal labor pains.

II. FORCIBLE DELIVERY. ACCOUCHEMENT FORCÉ.

Definition.—By accouchement forcé we understand three operations: viz., (1) the complete rapid instrumental or manual dilatation of the cervical canal; followed (2) by either combined or internal version or the application of the forceps; and (3) the immediate extraction of the child. The accouchement forcé of the old writers upon obstetrics was often quite another and more serious operation, for the condition of the cervical canal was frequently lost sight of and the operation too frequently meant, (1) the plunging of the hand or the application of the forceps through a cervical canal imperfectly dilated or torn by the insertion of the hand, and (2) the immediate extraction of the fetus through this constricted or lacerated os. That the latter definition of the term still obtains is proved by the accidents that are constantly occurring during the extraction of the fetus.

Indications.—In the event of placenta prævia when the hemorrhage has been temporarily arrested and there is necessity for immediate evacuation of the uterine contents, there is probably presented the most urgent indication for the performance of this operation. In case of the sudden death of the mother this procedure is indicated only when there is hope of delivering the child more quickly by this method (see Post-mortem Delivery, page 669). In cases of eclampsia when other means fail and it is necessary to empty the uterus, this

FIG. 1168.—DANGERS OF A RAPID BREECH EXTRACTION THROUGH AN IMPERFECTLY DILATED OS. The external os is not fully dilated or is paralyzed. Traction on the legs results in extension of the head and arms.

FIG. 1169.—MANUAL EXTRACTION OF THE FORE-COMING HEAD BY THE INTRODUCTION OF TWO FINGERS INTO THE RECTUM. RITGEN'S METHOD.

method may be indicated, as rapidity is required, since convulsions are more likely to occur as long as manipulation of the uterus continues.

Dangers.—Unless performed in the most rapid and scientific manner, this operation is full of danger, being attended by a high percentage of maternal mortality. It is apt to be very destructive to the tissues of the uterus. In placenta prævia the danger of uterine rupture and infection is a contraindication to this procedure.

Operation.—(See Manual Dilatation of Cervix, page 895, and Version, page 919, also Breech Extraction, page 968.)

III. MANUAL EXTRACTION OF THE FORE-COMING HEAD. RITGEN'S METHOD (Fig. 1169).

Definition.—The digital extraction of the head in head-first delivery at the end of the second stage by the introduction of two fingers into the rectum of the mother, favoring extension of the head, in vertex presentation, through

the vulval orifice. The operation is often combined with that of expressio fœtus.

Indication.—Tedious or powerless labor at the end of the second stage; when the relative indication for the forceps exists at this time and no instrument is available. It may also be employed when the pains are so severe that control of the head is impossible. In this case an anesthetic is given and the head is extracted in the interval between contractions.

Dangers.—Injury of the rectal mucous membrane of the mother or of the eyes of the fetus is liable to result from too vigorous or carelessly applied pressure. I have seen severe venous hemorrhage. The operation is not aseptic.

Operation.—Anesthesia is not necessary, but in great rigidity of the part its use is desirable, especially in primiparæ. Two fingers of the right hand are introduced into the rectum and continued pressure is brought to bear in vertex presentation upon the forehead, the malar prominences, the superior maxilla, or the chin, thus gradually extending the head through the ostium vaginæ. Great care must be taken to avoid pressure upon the eyes. Similar procedures are advocated by others, viz., combining pressure upon the face of the fetus by one or two fingers in the rectum with restraint of the head during its advance by pressure applied to the exposed portion of the vertex. The aim of all is to advance the head gradually, in the absence of uterine contractions or in the intervals between pains, under anesthesia in cases in which the contractions are so severe and frequent that protection of the perineum is impossible without an anesthetic. It is preferable to avoid the lack of asepsis involved in this operation by using a sufficient amount of pressure upon the fundus to enable the middle finger of the right hand to obtain a point of pressure upon the forehead of the fetus by reaching behind the anus, without entering the rectum. (Compare Perineal Protection, page 480 and Fig. 616)

IV. SHOULDER EXTRACTION IN HEAD-FIRST CASES.

After the birth of the head there sometimes occurs delay in delivery of the shoulders, which may result in the death of the fetus from prolonged pressure upon the cord. Such delay may be of maternal origin, from inefficient contractions, pendulous abdomen, etc. Fetal causes include actual shortness of the umbilical cord or relative shortness from the presence of loops around the neck or body; failure of rotation; diseases, such as ascites; deformities of the fetus, and relative or actual largeness of the fetal shoulders or chest. (1) If the pains are weak, and after allowing the uterus a little rest, stimulation of the fundus is indicated. (2) If a pendulous abdomen retards expulsion, supporting the abdomen and uterus and exerting pressure upon the fundus may obviate the difficulty. (3) If expulsion of the shoulders is retarded by actual shortness of the cord, it may be necessary to ligate it in two places and cut between the ligatures. If the cord is around the neck, the loop should be drawn down if possible and passed over the head so as to relieve it; failing in this, it should be loosened by traction and the body delivered through the loop (Fig. 619). If this is not accomplished, it must be divided between ligatures. (4) If the delay is from failure of rotation, one may aid restitution of the head and thus cause rotation of the shoulders into the conjugate diameter. But if this fails, rotation of the shoulders may be obtained by direct pressure of the fingers in the vagina. If one is again unsuccessful, or if uterine stimulation and pressure do not overcome the obstruction due to a large chest, ascites, or a monstrosity, extraction of the shoulders is indicated. Mutilatory

operations are a final resort. (5) In extracting the shoulders traction is best employed only during the pains. I am accustomed to hold the head in the hand

FIG. 1170.—SHOULDER EXTRACTION IN HEAD-FIRST LABORS. Directing the anterior shoulder well up behind the symphysis, thus securing the engagement of the cervico-acromial diameter.

FIG. 1171.—SHOULDER EXTRACTION IN HEAD-FIRST LABORS. Delivery of the posterior shoulder, either spontaneously or artificially.

FIG. 1172.—SHOULDER EXTRACTION IN HEAD-FIRST LABORS. Delivery of the anterior shoulder by depressing the head and making gentle downward traction upon it.

FIG. 1173.—EXTRACTION OF THE POSTERIOR SHOULDER BY TRACTION WITH ONE FINGER IN THE POSTERIOR AXILLA AND THE PALMS OF THE HANDS UPON THE HEAD.

and gently raise it so that the anterior shoulder is well up behind the symphysis, thus securing at the outlet the cervico-acromial diameter of the fetus instead of

the bisacromial diameter (Fig. 1170). The posterior shoulder is now delivered over the perineum by pressure on the fundus (Fig. 1171), traction on the head (Fig. 1171) or in the axilla. The posterior shoulder is thus delivered first, contrary to the custom of many. (Compare Shoulder Delivery, page 486.) (6) The anterior shoulder, up to this time behind the symphysis, is now delivered by depressing the head, and making gentle downward traction upon it (Fig. 1172). Traction with a finger in the anterior axilla may be necessary. (7) Some advise pushing up the anterior shoulder until the neck is under the pubic arch, drawing downward until the posterior shoulder is at the edge of the perineum, then carrying the head backward, so that the anterior shoulder may emerge under the arch (Fig. 1173). (8) Blunt hooks are sometimes advised for exerting traction in place of the finger. Either may cause fracture of the humerus, separation of its epiphysis, or temporary paralysis of the arm. The blunt hook is the more likely to cause such damage.

V. BREECH EXTRACTION.

The general rule for the conduct of labor with breech presentation is to do only what is necessary to prevent early rupture of the membranes and so to obtain as complete dilatation of the parturient canal as possible before passage of the head. If everything progresses favorably, the physician is called upon to do nothing until the umbilicus is delivered, except to support the trunk after it is born, and to watch the fundus carefully and constantly in order to prevent displacement of the arms above the head. Occasionally, however, the breech may be arrested either above or at the brim, or in the pelvic cavity.

Dangers.—Injury to either the mother or the fetus may result from breech extraction. Fracture or dislocation of the femur of the fetus, injury of the femoral blood-vessels, or temporary paralysis of the lower extremities may follow traction by any method involving pressure in the groin, but is most likely to take place when the blunt hook is used. Laceration of the maternal soft parts may be caused by a slipping of the blunt hook or of the forceps applied to the breech. The forceps may also injure the spinal cord or abdominal organs of the fetus, and the blunt hook the genitals. It is thus seen that serious results may follow the application of the forceps or the careless use of the blunt hook, and therefore these procedures should not be indiscriminately employed.

(A) ARREST OF THE BREECH ABOVE THE PELVIC INLET.

Obliquity of the uterus may cause the breech to rest upon the pelvic brim, preventing its advance. When this occurs, the fetus may be raised slightly and the breech pushed over the pelvic inlet and held in that situation until it has engaged. This manœuver may be executed by external abdominal manipulation or by two fingers in the vagina or by the two combined.

(B) ARREST OF THE BREECH AT THE INLET.

This may be due to contraction or deformity of the pelvis or to unusual size of the fetus. At times the obstacle may be overcome by simple pressure upon the fundus. If this fails breech extraction may be demanded for the following

indications: on the part of the mother: (1) Exhaustion from prolonged efforts at expulsion, (2) severe hemorrhage, (3) rise of temperature, (4) convulsions, (5) prolonged compression of the soft parts (6) varicosities or œdema of the external genitals. Indications on the part of the fetus are: (1) Commencing asphyxia, shown by increased rapidity and later slowness and irregularity of the fetal heart; (2) prolapse of the cord.

FIG. 1174.—BREECH EXTRACTION WITH THE BREECH AT OR ABOVE THE PELVIC INLET. BRINGING DOWN THE ANTERIOR LEG.

FIG. 1175.—BREECH EXTRACTION. DELIVERY OF A SMALL OR PREMATURE FETUS BY DIRECT MANUAL TRACTION UPON THE BREECH, THE THUMB AND THIRD AND FOURTH FINGERS IN THE GROINS, AND THE FIRST AND SECOND FINGERS OVER THE BACK OF THE FETUS.

Arrest of the breech at the brim of the pelvis may be overcome by one of the following procedures, which can be assisted by pressure upon the fundus. Whichever method is employed, it is imperative to keep the fundus closely in contact with the fetus, in order, as has been stated above, to prevent displacement of the upper extremities above the head. Any form of traction used should be exerted only during the pains.

1. Traction upon a Leg Brought Down (Fig. 1174).—Under anesthesia the hand whose palm can most conveniently be placed upon the abdominal surface of the fetus is introduced into the uterus in this position. The anterior foot is seized and brought down. It is important that this foot should be chosen rather than the posterior, because in the latter event traction tends to bring the anterior buttock over the front portion of the brim of the pelvis, thus preventing descent.

FIG. 1176.—DOUBLE SLING APPLIED TO THE BREECH, SHOWING FAULTY AND CORRECT LINES OF TRACTION.

Care must be taken that prolapse of the cord does not occur when the foot is brought down. After the foot has been drawn out of the vulva traction on it is exerted downward and backward in the axis of the pelvic inlet (Fig. 1179). Pressure upon the fundus aids in bringing the posterior groin within reach, when one or two fingers introduced into it may further assist extraction by distributing the force over both lower extremities and so diminishing the danger of injury to the one brought down (Fig. 1180). The other foot may be brought down also, but better dilatation of the soft parts is obtained when this is not done. Traction downward and backward is continued, the extremities being wrapped in a hot sterile towel. As the breech emerges it is drawn forward to avoid lacerating the perineum. If the legs are extended along the body, and this is discovered early by abdominal palpation before rupture of the membranes, the difficulty can be overcome by external cephalic version. If not seen until later, great care must be used in flexing the extended leg. I introduce the hand as far as the popliteal space,

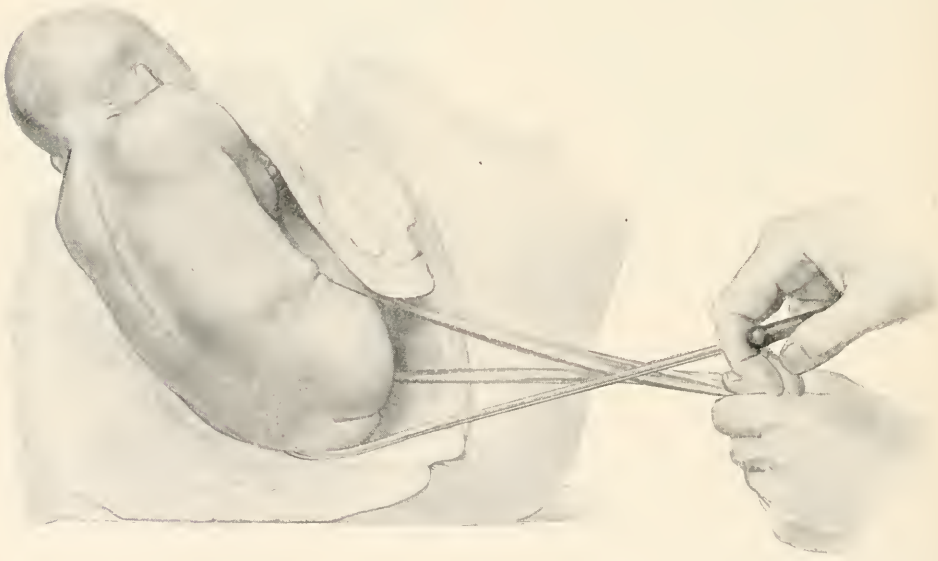


Fig. 1177.—Breech Extraction. Sling Applied to the Anterior and the Blunt Hook to the Posterior Groin.

and with two fingers encircling the upper third of the leg gently flex the same downward. The leg and the foot are thus easily reached and brought down. This procedure is better than that of introducing the hand deep into the uterus to reach the feet near the fundus.

2. **Digital Traction.**—If a foot is not or cannot be brought down, a finger passed through the anterior groin may serve for applying traction. As soon as this, aided by pressure upon the fundus, has brought the posterior groin within reach, two fingers of the other hand in this groin can be used to assist. Various modifications of digital traction are advised by different operators. Some apply pressure in the posterior groin by an index-finger in the mother's rectum while the corresponding finger of the other hand is employed in the anterior groin. Others exert traction by the whole hand in the vagina with the thumb over one iliac crest of the fetus and the little finger over the other, while the remaining fingers are extended along the back (Fig. 1175).

3. **The Fillet** (Fig. 1176).—This may be used when the groin cannot well be reached in order to exert traction, and also when a greater amount of force is required than can be commanded by the digital method. The fillet, a strip of sterile bandage, is passed up to and across the anterior groin and down on the other side of the thigh, forming a loop over the groin. Some obstetricians employ a second fillet over the opposite inguinal region in order to be able to use greater force without increasing the strain upon one portion of the body. The fillet may be carried into position by a loop of string attached to a catheter containing a stylet (Fig. 1109). The latter is bent so as to form a curve, which when passed up to the groin, turned toward the child's abdomen, and drawn down into the groin, will bring its tip, threaded with a loop of string, between the thighs of the fetus. This loop is seized, drawn down, and fastened to the fillet. When the catheter and stylet are withdrawn the fillet passes into position. In exerting traction by means of the fillet, care must be taken to pull during the pains in such a direction as to correspond with the mechanism of labor and so to diminish the liability to fracture the femur.

4. **The Blunt Hook** (Fig. 1177).—A blunt hook, consisting of a straight shank with an extremity whose curve should be such as to fit the inguinal region of the fetus, is advised by some as affording means for stronger traction. It is passed up, as is the catheter for placing the fillet, between two fingers of the left hand and the child's body. Its point is rotated so that when drawn down its curve lies in the groin and its point is felt between the thighs. The same precautions must be taken in regard to the line of traction as with the fillet. With this, as with the fillet, a finger in the groin may assist when the breech has been brought sufficiently low.

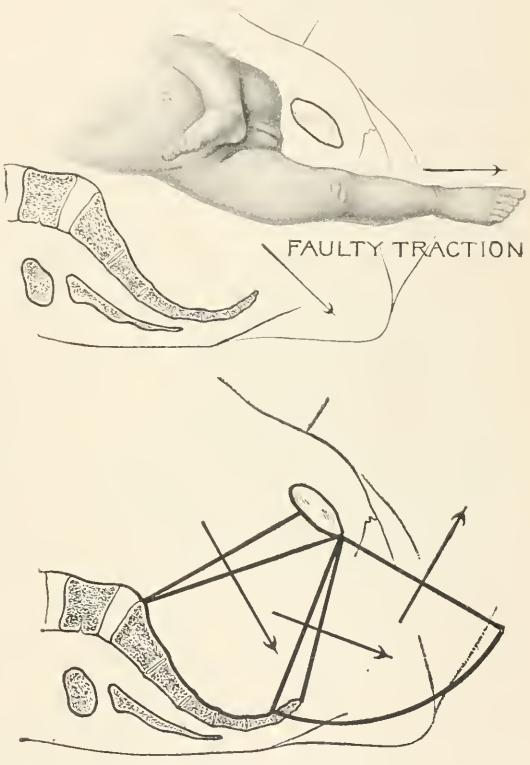


FIG. 1178.—BREECH PRESENTATION WITH THE LEFT OR ANTERIOR BUTTOCK CAUGHT AT THE PELVIC INLET BEHIND THE SYMPHYSIS, AS THE RESULT OF FAULTY TRACTION ON THE PROLAPSED LEG IN A HORIZONTAL PLANE.

5. **Forceps.**—This may be applied to the breech as a last resort (See Forceps, page 1003.)

(C) ARREST OF THE BREECH IN THE PELVIC CAVITY.

When impaction of the breech occurs in the pelvic cavity, it is usually impossible to bring down a foot. The obstetrician must rely upon external abdominal pressure alone, or combined with digital traction in the groin, or the use of the

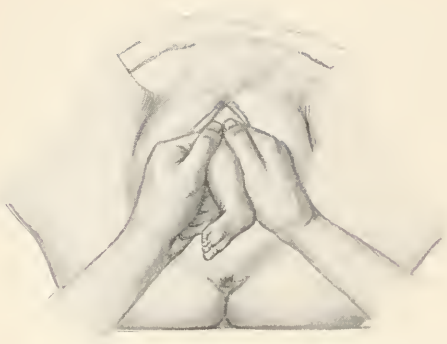


FIG. 1179.—BREECH EXTRACTION. TRACTION ON A LEG.

FIG. 1180.—BREECH EXTRACTION. TRACTION ON THE ANTERIOR LEG AND GROIN AND POSTERIOR GROIN.

FIG. 1181.—BREECH EXTRACTION. TRACTION ON BOTH GROINS.

FIG. 1182.—BREECH EXTRACTION. DOWNWARD TRACTION ON THE GROINS.

FIG. 1183.—EXTRACTION OF THE AFTER-COMING HEAD. DELIVERY OF THE POSTERIOR ARM.

fillet or blunt hook. The forceps may be employed as in cases of arrest at the brim. Symphyseotomy has been advised in these cases. When the child is dead and other methods have failed, the cranioclast applied to the breech will usually succeed in effecting delivery. One blade is introduced into the fetal rectum, the other applied over the sacrum (Fig. 1147), or the cephalotribe may be applied over the trochanters and sides of the pelvis if it is necessary to diminish the breadth of the breech (Fig. 1154).

The uterus must be made to retract closely over the fetus during the whole period of its delivery. This is best accomplished by having an assistant grasp the fundus with both hands, making a funnel, thus preserving head flexion and reducing the danger of displacement of the arms (Fig. 1167). Traction should be made during the pains when the latter are not too far apart; it should be slow to allow the uterus completely to retract and thus lessen the danger of hemorrhage; the direction of the traction should be downward and somewhat backward, and steady tractions are preferable to rotary or pendulum movements.

Extraction by the Feet (Fig. 1179).—If a single leg presents, the foot is seized between the middle and index fingers with the thumb on the sole, and when the leg is drawn outside the vagina it is wrapped in a warm towel and grasped with the whole hand, the thumb always being directed upward and applied to the dorsal surface of the leg. The fetus as delivered should always be covered with warm moist towels (100° F.) to lessen the danger of the air of the delivery room (70° to 80° F.) exciting respiratory movements. The direction of the traction should be sufficiently backward to avoid friction at the pubic arch, and until the buttocks appear the extracting hand should shift upward so as to grasp the leg as near the maternal parts as possible; whichever leg is seized rotates forward into the pubic angle during extraction. Should both legs present in the vagina, the middle finger is placed between the feet and the index and ring fingers encircle the external malleoli until the legs are delivered, when the right leg should be seized with the right hand and the left with the left hand. The normal rotation of the fetus can thus be controlled. Leg traction should, by reason of the dangers of dislocation and fracture, be discontinued as soon as the buttocks have been brought into the vulval outlet, when traction on the breech should be substituted (Figs. 1180, 1181, 1182).

Extraction by the Breech (Fig. 1183).—The fetal pelvis is grasped by inserting an index-finger in each groin, placing the thumbs over the fetal sacrum, and steadying the remaining three fingers of each hand over the corresponding thighs. Following the normal mechanism, the fetus is now slowly extracted until the lower angle of the anterior scapula appears, during which time attention should be paid to the cord.

Management of the Cord.—Should the cord be found between the child's legs, the placental extremity should be drawn down and the loop, if possible, slipped over the posterior thigh. In rare cases, when this procedure fails, the cord should be cut between two ligatures. In all cases as soon as the umbilicus appears at the vulva the cord should gently be drawn down a few inches and placed, if possible, in the posterior segment of the outlet, in order to avoid dangerous traction upon the navel.

VI. EXTRACTION OF THE AFTER-COMING HEAD.

(1) *Delivery of Displaced Arm.* (2) *Manual Rotation of Transversely Placed Head.* (3) *Uterine Compression.* (4) *Face-and-shoulder Traction, or Smellie Method.* (5) *Jaw-and-shoulder Traction, or Method of Smellie-Veit, Mauriceau.* (6) *Jaw Traction and Suprapubic Pressure, or Wigand-A. Martin Method.* (7) *Jaw, Shoulder Traction, and Suprapubic Pressure, or the Combined Method.* (8) *Foot-and-shoulder Traction, or Prague Method.* (9) *Forceps for the After-coming Head.* (10) *Delivery of the Head in Persistent Sacro-posterior Cases.*

It should be remembered that in all breech cases delivery must be completed within five to ten minutes of the emergence of the umbilicus, as the pressure exerted upon the cord will usually result in fatal asphyxia if continued longer than that time. It is also to be understood that during all these manipulations the body of the child is to be wrapped in hot, sterile towels, as diminution of the body-temperature is extremely dangerous. In the following descriptions the direction of traction is described in relation to the long axis of the mother's body; thus, downward means toward her feet; backward signifies toward the floor if she lies upon her back.

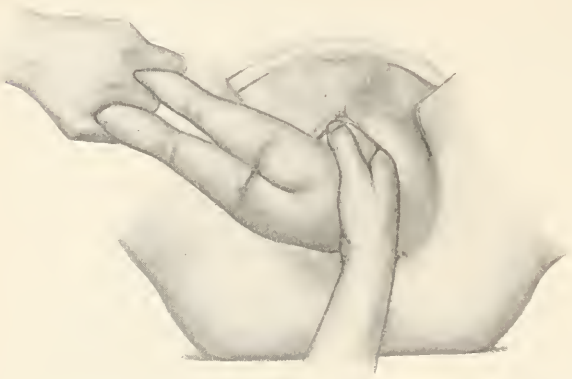


FIG 1184.—EXTRACTION OF THE AFTER-COMING HEAD. DELIVERY OF THE POSTERIOR ARM.

FIG. 1185.—EXTRACTION OF THE AFTER-COMING HEAD. DELIVERY OF THE POSTERIOR ARM.

Dangers. — Traction upon the legs may cause separation of the epiphyses. Pressure upon the clavicles by the hand grasping the shoulders may fracture them and cause paralysis of the upper extremities by pressure upon the brachial plexus. Dislocation of the cervical vertebræ with laceration of the spinal cord is more likely to result from the use of the Prague method than from any other. Such traction may also cause laceration of blood-vessels and may result in hematoma of the sternocleidomastoid. The compression to which the cord is subjected, particularly in forceps delivery or birth of the head of a persistent sacro-posterior case, may cause cerebral hemorrhage or fracture of the skull. Traction on the jaw by the finger in the mouth may lead to dislocation. Misdirected force in bringing down an extended

arm may cause fracture of the humerus, and attempts to cause rotation of the head by force exerted upon the trunk alone may dislocate the cervical vertebræ.

1. **Delivery of the Extended Arms** (Figs. 1183 to 1189).—One arm or both may become extended from too energetic traction upon the body of the fetus in simple breech presentations, or this may occur during the necessary manipulations in the delivery of an impacted breech; and, indeed, without these causes the arms may become extended at full length, beside the child's head. Before delivery of the head is possible, unless the child is very premature, the arms must be brought into a normal position. The posterior arm should first be manipulated, as the sacral hollow gives more room than there is anteriorly. The child's legs being grasped by the operator's left hand just above the malleoli, its body is carried upward and flexed over the mother's right hip in left sacro-positions, and over the left hip in right sacro-positions (Fig. 1184). This moves the posterior fetal shoulder down into the pelvis. The operator's index and middle fingers of the hand whose palm corresponds to the dorsum of the fetus are inserted into the vagina till the child's scapula is reached, and then along the back of the arm to the elbow, which is pulled forward into the sacral cavity so that the child's arm comes in front of its face. By hooking a finger through the elbow-joint and pulling downward the arm is flexed, and by extension the forearm is delivered on the chest of the fetus (Fig. 1186). The process is now reversed and the right hand grasps the fetal body and carries it over the mother's left thigh, etc., till the other arm is delivered. These manipulations must be conducted with great gentleness and care to avoid fracture of the humerus.

FIG. 1186.—EXTRACTION OF THE AFTER-COMING HEAD. DELIVERY OF THE POSTERIOR ARM.

Dorsal Displacement of the Arm (Fig. 694).—A far less common accident than simple extension is dorsal displacement of the arm. The arm is extended along the head, the elbow flexed, and the forearm behind the neck. This displacement may result from attempts to rotate the trunk or head, the arms not rotating with the body and so passing behind it. This constitutes a serious obstacle to delivery, as the forearm prevents the occiput from passing under the pubic arch. It is overcome by rotating the body in the direction opposite to that which caused the displacement, thus bringing the arm in front of the fetal head. The extremity may then be drawn down, as in the case of simple extension of the arm above the head. If the occiput has been directed posteriorly by the manœuvers and fails to rotate forward at once after extraction of the arm, this should be brought about artificially in the following manner.

2. **Manual Rotation of the Transversely Placed Head** (Figs. 1190, 1191).—

When the head presses with its long diameter transverse or with the occiput in the sacral hollow, the head and trunk should be firmly held by the Smellie or Smellie-Veit grasp, and rotated so as to bring the occiput to the front, when the delivery can be completed. (See below.) Rotation by grasping the trunk alone must be carefully avoided, as it is liable to cause injury to the spinal cord

FIG. 1187.—EXTRACTION OF THE AFTERCOMING HEAD. ROTATION OF THE FETUS IN ORDER TO BRING THE ANTERIOR ARM IN THE POSTERIOR OR ROOMIER SEGMENT OF THE PELVIS.

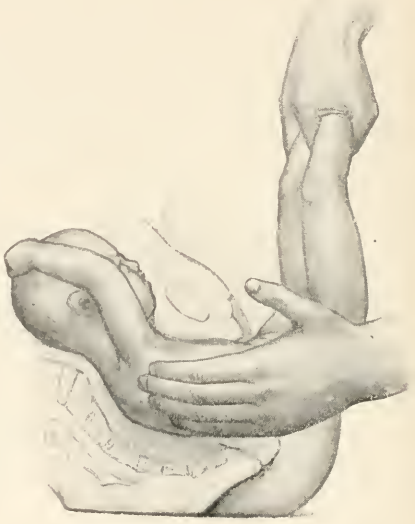


FIG. 1188.—EXTRACTION OF THE AFTERCOMING HEAD. DELIVERY OF THE ARMS IN THE SACRO-POSTERIOR POSITION OF THE FETUS.

FIG. 1189.—EXTRACTION OF THE AFTER-COMING HEAD. DELIVERY OF THE ARMS IN THE SACRO-POSTERIOR POSITION OF THE FETUS.

if the head fails to rotate at the same time. I have found that one finger in the child's mouth, the thumb, third, and fourth fingers over the shoulders, and the second and third fingers on the occiput is a very reliable method for head rotation (Figs. 1191, 1193).

3. **Uterine Compression** (Fig. 1194).—When conditions arise that demand speedy delivery, it may be attained by suprapubic uterine compression. Uterine

compression is of great value and power in expelling the head, as the force is exerted almost directly upon the head itself. Applied by a trained assistant, it may advantageously be combined with the Smellie or Smellie-Veit method.

4. **Face-and-shoulder Traction, or Smellie Method.**—The operator's right or left hand is passed between the thighs and then between the arms of the child, whose body rests upon the forearm while the arms and legs hang down at each side. For face traction that hand should be chosen the palm of which naturally

FIG. 1190.—EXTRACTION OF THE AFTER-COMING HEAD. MANUAL ROTATION OF THE FETUS IN ORDER TO FAVOR ANTERIOR ROTATION OF THE OCCIPUT IN SACRO-POSTERIOR POSITIONS.

FIG. 1191.—EXTRACTION OF THE AFTER-COMING HEAD. MANUAL ROTATION OF THE TRANSVERSELY PLACED HEAD. The upper figure shows the rotation completed.

corresponds with the face of the fetus; thus, the right hand when the face looks to the left, and vice versa. The index and middle fingers of this hand enter the vagina and their tips are placed one at each side of the child's nose. The other hand grasps the shoulders from behind, the index-finger over one, the other three fingers over the other clavicle. The tips of these fingers first aid flexion of the head by pressing the occiput upward, while the fingers applied to the face of the fetus attempt to draw it down. When the head is well flexed, traction is made down-

ward with both hands, the second grasping the shoulders as described. As soon as the occiput is well engaged under the pubic arch the body is raised over the mother's abdomen while the fingers of the internal hand continue to exert traction, as those of the external do upon the shoulders. As the face emerges over the perineum the shoulder hand must leave the shoulders and protect the perineum by drawing the vulval tissues backward and toward the median line and by preventing sudden expulsion of the forehead. This method of traction is inferior to the following, also recommended by Smellie, because the fingers on the face of the child cannot secure a firm grasp upon the slippery skin for traction. It was suggested by him as avoiding danger to the jaw, which the Smellie-Veit method involves.

5. Jaw-and-shoulder Traction, or Method of Smellie-Veit or Mauriceau Method (Fig. 1196).—This manœuver differs from the last only in that traction is applied by the index-finger in the mouth instead of by two fingers upon the face. It affords a far more effectual grasp upon the face. Great care is necessary lest the lower jaw be injured by the use of excessive force.

Fig 1192.—Extraction of the Aftercoming Head. Digital Flexion of an Extended Head Above the Pelvic Inlet.

Fig. 1193.—Extraction of the Aftercoming Head. Digital Flexion of a Partially Extended Head at the Pelvic Inlet.

6. Jaw Traction and Suprapubic Pressure, or Wigand-A. Martin Method (Fig. 1197).—The child's body lies astride the operator's right or left arm, as in the preceding methods, while the fingers are inserted into the vagina, the index-finger being passed into the infant's mouth so that by traction complete flexion of the head may be secured. The fingers of the remaining hand are placed on the abdomen over the occiput which lies just above the symphysis. By the combination of the pressure above in the axis of the parturient canal and the traction below, the head is delivered. On the appearance of the head at the vulva the child's body is carried upward toward the mother's abdomen, which lessens the danger of perineal laceration.

7. Jaw, Shoulder Traction, and Suprapubic Pressure, or Combined Method (Fig. 1198).—In difficult cases it is advisable to use a combination of the above methods, namely, the operator performs jaw-and-shoulder traction as in the Smellie-Veit method, while suprapubic pressure, as in the expression of the fetus, is made by a competent assistant.

8. Foot-and-shoulder Traction, or Prague Method (Fig. 1199).—One of the operator's hands grasps the child's feet from behind, the middle finger passing between the ankles. The other hand grasps the child's shoulders as in the Smellie method, and downward and backward traction is exerted by both hands till the perineum is well distended by the head. The hand grasping the shoulders is now used as a fulcrum around which the head is rotated by raising the body and lower extremities over the mother's abdomen while continuing to exert traction with the hand holding the ankles. This method involves the use of great force, which may cause dislocation or fracture of the neck or clavicles of the child, *and should never be employed.*

FIG. 1194.—EXTRACTION OF THE AFTER-COMING HEAD. SUPRAPUBIC UTERINE COMPRESSION.—(*From a photograph taken at the Emergency Hospital.*)

9. Forceps for the After-coming Head. (See Forceps, page 1003).—This method is rapid and valuable and may be used when the other methods fail. The child's body is carried up over the maternal abdomen. The blades of the forceps are applied to the fetal head and delivery proceeds as in the usual forceps operations. It is used only after failure of manual extraction and never in cases with the head above the inlet.

10. Delivery of Head in Persistent Sacro-posterior Cases (Figs. 1200).—If manual rotation, as described above, of the head whose occiput fails to rotate anteriorly is unsuccessful, the head must be extracted with the face anterior. This is accomplished in one of two ways: (1) If the chin is caught above the symphysis, traction upon the fetus should be directly forward toward the ceiling when

the woman is in the dorsal position. External abdominal pressure is made downward and backward upon the head at the same time. The head rotates around the symphysis and the occiput is born first. (2) If the chin is below the symphysis, the woman is placed upon her back with the hips over the edge of the bed or table, so that traction can be exerted directly backward—toward the floor. The

FIG. 1195.—EXTRACTION OF THE AFTER-COMING HEAD. FACE AND SHOULDER TRACTION. SMELLIE METHOD.

other hand presses downward upon the head above the pubis, and, if necessary, a finger in the rectum can further increase flexion of the head by pushing up the occiput. Jaw traction will also assist. By this method the face is born first.

Method Advised.—As a general rule, preference should be given to the Smellie-

FIG. 1196.—EXTRACTION OF THE AFTER-COMING HEAD. JAW-AND-SHOULDER TRACTION. MAURICEAU OR SMELLIE-VEIT METHOD.

Veit method, combined with suprapubic uterine compression by a trained assistant, or the Wigand-Martin method if unassisted and the Smellie-Veit fails. If these are not successful, the forceps must be rapidly applied, remembering that five to ten minutes is the allotted time from the appearance of the umbilicus to the birth of the head.

FIG. 1197.—EXTRACTION OF THE AFTER-COMING HEAD. JAW TRACTION COMBINED WITH SUPRAPUBIC PRESSURE. WIGAND-A. MARTIN METHOD.

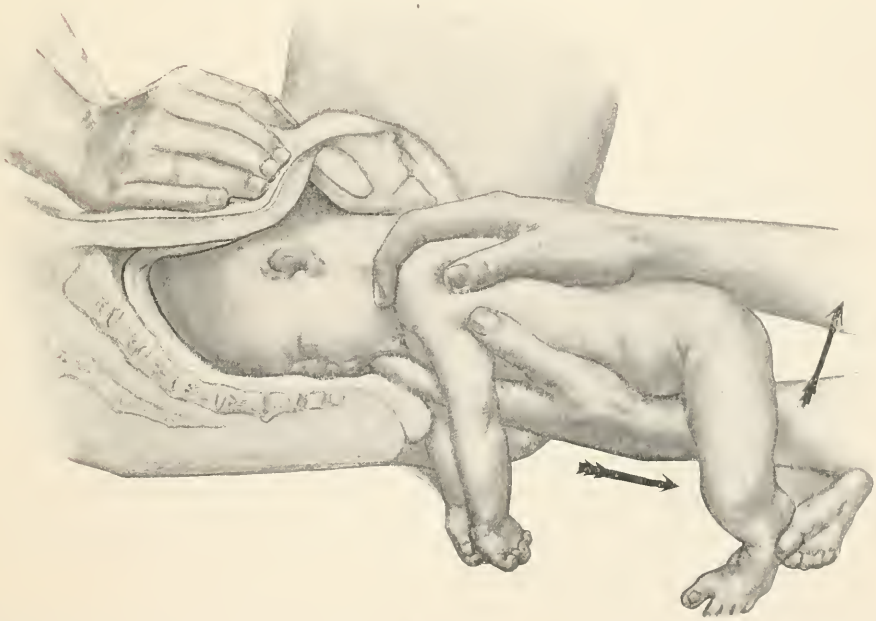


FIG. 1198.—EXTRACTION OF THE AFTER-COMING HEAD. JAW, SHOULDER TRACTION, AND SUPRAPUBIC PRESSURE. THE COMBINED METHOD.

FIG. 1199.—EXTRACTION OF THE AFTER-COMING HEAD. SACRO-POSTERIOR POSITION. SHOULDER AND LEG TRACTION. PRAGUE METHOD.

FIG. 1200.—EXTRACTION OF THE AFTER-COMING HEAD. PERSISTENT SACRO-POSTERIOR POSITION. JAW AND SHOULDER TRACTION AND EXTENSION OF THE FETUS.

VII. THE FORCEPS.

Historical.—This instrument in some form evidently dates back to some time before the Christian era, as crude patterns of it have been found in connection with archæological investigations in Egypt and elsewhere. By reason of the complete silence of classical authors upon so important a subject as instrumental extraction of living children, it has been assumed that the forceps of that period was used only for the extraction of dead fetuses. Somewhere about 1600 it is believed that Peter Chamberlen, of London, began to use the forceps as a matter of routine in obstetrical practice. We do not really know when or by whom it was invented, nor how the inventor was influenced toward his innovation. It is certain, however, that the Chamberlens possessed a monopoly of the instrument, and that the secret was virtually preserved among the members and pupils of the family until the independent invention of a forceps by Palfyn in 1723, together with Chapman's published description of Chamberlen's instrument in 1725, had made this discovery the common property of the profession. The Chamberlen forceps consisted of fenestrated blades joined to a scissor-like handle. The cephalic curve was admirable, but there was no pelvic curve, shank, or lock. After adaptation the blades were held in place by tape wound tightly between the handles and blades where the halves cross. The absence of pelvic curve and shank shows conclusively that the Chamberlens practised nothing but the low operation. After knowledge of the forceps had become the common property of the profession, but a few years elapsed before the good results of publicity became apparent. Levret, the leading obstetrician of his age and a man of mechanical genius, added at one stroke the pelvic curve, shank, and lock (about 1747). The modern long forceps has undergone but little alteration since his time. Smellie, his great British contemporary, devised the so-called English lock, but his chief service to midwifery lies rather in his discoveries concerning the mechanism of labor than in forceps construction. A century elapsed before the forceps underwent another revolutionary advance. The imperfection of forceps traction with the head at the brim appears to have been recognized during the first quarter of the nineteenth century, and attempts in the direction of axis traction were made by attaching traction cords, accessory rods, etc., to the blades of the high forceps. None of these devices was successful in making true axis traction, as the "line of pull" necessarily ran within the birth canal. The difficulty was overcome to a certain extent by using the high forceps as a lever with the hand as a fulcrum. Finally, in 1877, Tarnier introduced to the notice of the profession his axis-traction forceps which, in the opinion of most obstetricians, has permanently solved the problem of traction at the inlet. During the quarter century just elapsed there have been no advances in forceps construction.

Description.—The forceps consists of two halves almost identical in construction. They cross like the branches of scissors and interlock, and are known as the arms. The left arm is the one which is held with the left hand and introduced into the left side of the pelvis and which contains the pin or screw of the lock. The right arm, which is introduced into the right side of the pelvis with the right hand, contains a notch for the reception of the pin or screw. Each arm of the forceps consists of a blade, shank, handle, and a portion of the lock. The blade is fenestrated to secure lightness, and its free extremity is termed the apex (Fig. 1201). Solid-bladed forceps are preferred by a few operators, but by most are used only for special actions, such as rotation (Fig. 1206). Some authorities reject the solid blades as liable to slip over the head. The blade has a double curve, one being on the flat, which corresponds to the convexity of the fetal skull, the other on the edge, to conform to the curve of the pelvic excavation. These are known respectively as cephalic and pelvic curves (Fig. 1202). When the instrument is locked, the handles come together to form a single grip for the operator's hand, and several devices are added to increase the strength of the hold, such as expansion at both ends, and corrugation in the continuity (Fig. 1202). The entire instrument should be constructed of well-tempered steel, which is also suitable for ready sterilization. In regard to correct proportions, the blades in position should be at least 3 inches (7.62 cm.) apart at the acme of the cephalic curve, and 1 inch (2.54 cm.) apart at the tips. When the instrument lies upon its convex edge, the tips of the forceps should be $3\frac{1}{2}$ inches (8.89 cm.) above the general level; in other words, the highest portion of the pelvic curve is at the tip. Forceps

having a short shank and no pelvic curve may be used for the low operation, but such a pattern is unnecessary, as the ordinary instrument with its double curve and longer shank can be used with equal readiness in any part of the pelvis. Of the innumerable patterns of forceps, the following are the most popular: Naegele and Breus in Germany; Tarnier in France (Fig. 1221); Simpson's in England; Simpson, Elliott (Fig. 1203), and Tarnier in America.

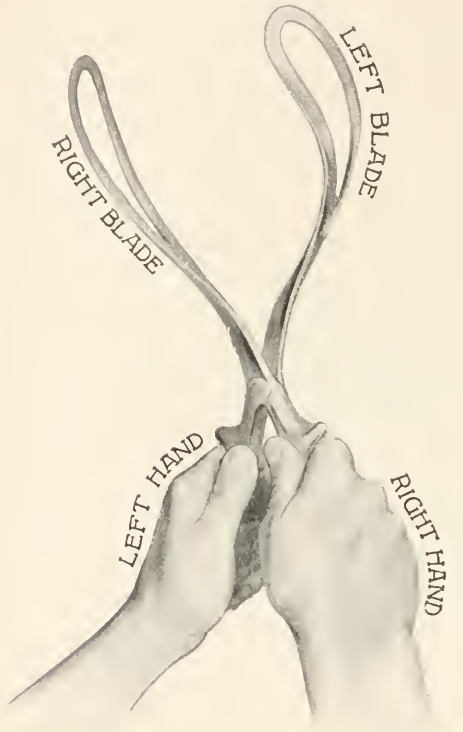


FIG. 1201.—THE FORCEPS. THE LEFT ARM IS THE ONE WHICH IS HELD IN THE LEFT HAND AND INTRODUCED INTO THE LEFT SIDE OF THE PELVIS. THE RIGHT ARM, WHICH IS INTRODUCED INTO THE RIGHT SIDE OF THE PELVIS, IS HELD IN THE RIGHT HAND.

Antero-posterior Forceps.—A French writer, Pénoyée,* has devised a special form of forceps in which one blade has a much greater degree of curvature than the other, so that when applied at right angles to the plane in which the ordinary forceps is used the blade with the more marked curvature fits into the hollow of the sacrum, and is thus supposed to render delivery easier. It may, however, be pointed out that the difficulties which require forceps delivery are encountered not while the head is in the hollow of the sacrum, but at the superior strait and at the outlet, at both of which points the peculiar shape of this forceps is of no advantage.

Straight Forceps.—Forceps without the pelvic curve have been made and recommended especially as rotators in occipito- and mento-posterior positions of the head. I have been unable to satisfy myself that as rotators they possess any advantages over the ordinary instrument.

Choice of Forceps.—Any instrument modeled after the Naegele or Simpson forceps will prove satisfactory. Personally I prefer the Elliott modification of Simpson's forceps in cases not requiring much axis-traction, and the Tarnier instrument for all high and difficult cases.

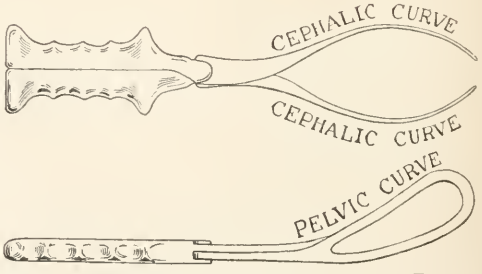


FIG. 1202.—THE CEPHALIC AND PELVIC CURVES OF THE FORCEPS.

Solid-bladed instruments are convenient for operations calling for much rotation, but the ordinary fenestrated forceps will give equally good results if intelligently used. Physicians providing themselves with one forceps only, will do well to procure the latest model of Tarnier's instrument, and accustom themselves to

* "Revue Clinique d'Andrologie et de Gynécologie," May 13 and June 13, 1895.

its use in low as well as high cases. One should see to it that the forceps is entirely of metal so as to withstand frequent boiling.

Frequency of Forceps Operations.—The proportion of cases in which delivery is completed with the forceps naturally varies in different clinics. During three years in the Paris Maternity (ending March 1, 1899) the forceps was applied 236 times in 4380 deliveries, about 6 per cent., or 1 in 16.67. Of the 236 extractions, 211 were examples of the ordinary low or median operation, while the remaining 25 were high-forceps cases, all for contracted pelves.* During one year at the Glasgow Maternity there were 187 forceps deliveries in 2179 confinements, about 8.5 per cent., or 1 in 11.7. Of 482 cases confined at the Maternity proper, there was 18 per cent. of forceps intervention, or 1 in 5.5; while of 1697 women confined at their homes by the Maternity staff, 6 per cent. were delivered by forceps, or 1 in 16.7.† During the year 1898 there were 6 forceps deliveries in 458 confinements at the Brussels Maternity, only about 1.3 per cent., or 1 in 77.‡ Ahlfeld (1897) reports 4000 cases with 110 forceps operations, or 2.75 per cent., or once in 36.3 cases.§ In 2200 confinements in two hospitals I found that

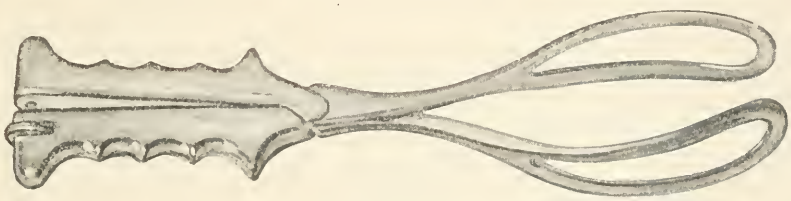


Fig. 1203.—Elliott's Modification of Simpson's Forceps.

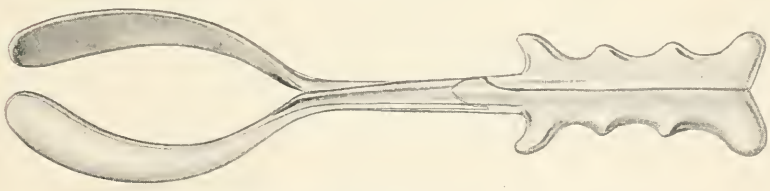


Fig. 1204.—McLane-Tucker Solid-bladed Forceps.

the forceps was applied in 208 cases, or in 9.45 per cent. of all cases, or once in 10.5 cases. In the 208 forceps operations, I found 24 were high operations, 43 median, 123 low, and 18 had no record of the position of the head in the pelvis.

Indications.—The question, "When is the forceps indicated?" is answered broadly as follows: It is to be used whenever labor is to be quickly terminated, whenever the life of the mother or child is in peril, provided that contraindications are absent. The dangers to which the mother, child, or both are exposed must naturally be of the sort which are removed or diminished by the termination of labor. When the latter is uncomplicated by any special condition like eclampsia or hemorrhage, the chief dangers are in exhaustion on the part of the mother and in asphyxia of the fetus; which is equivalent to stating that the anomalies of labor which require forceps are largely mechanical in character, and that therefore whatever imperils the mother by causing obstruction and

* Dubissy et Thoyer-Rosat: "Méd. Moderne," April 12, 1899.

† Black: "Trans. Glasgow Obstet. and Gynecol. Soc.," vol. 1, 1896–9, p. 71, appendix.

‡ "Journ. d'accouchements," Feb. 19, 1899.

§ Ahlfeld: "Lehrbuch der Geburtshilfe," second edition, 1898, p. 508.

delay also endangers the fetus by compression of the cord, placenta, head, or chest. The said anomalies of labor which produce these effects in the mother and child are equivalent to dystocia, maternal or fetal. While it is seldom difficult to recognize the presence of maternal conditions which demand forceps intervention, it is by no means always easy to determine when the fetus is in peril. If the heart-beat either increases or diminishes steadily, evidence is thereby furnished of disturbance of the placental circulation, which means peril for the child. This behavior of the heart must not be confounded with the slight variations which occur during a uterine contraction. The presence of meconium in the amniotic fluid is dubitable evidence of fetal distress. In breech presentations it means nothing at all, for it is expressed from the anus mechanically; and even in head presentations its presence may be inconclusive. I have fre-

FIG. 1205.—CLASSIFICATION OF FORCEPS OPERATIONS. HIGH OPERATION. MEDIAN OPERATION WITH COMPLETE RETRACTION OF THE CERVIX OVER THE PRESENTING PART. MEDIAN OPERATION WITH ONLY PARTIAL RETRACTION OF THE CERVIX OVER THE PRESENTING PART. LOW OPERATION.

quently seen healthy, unasphyxiated children born by the vertex after a copious escape of meconium. (Compare Asphyxia, Part IX.) As other evidence of the fetal state is not forthcoming, we must place our sole reliance on the fetal heart.

Special Indications.—Maternal exhaustion and fetal asphxyia are the general indications for forceps, but it is necessary to recapitulate the different forms of dystocia which tend to produce these conditions. The indications may proceed from anomalies of the expulsive functions, anomalies of resistance, certain presentations and positions of the child, and miscellaneous or non-mechanical complications of labor. (1) *Anomalies of expulsive forces:* Simple inertia without obstruction may require forceps. (See Part V.) Protracted labor without evidence of obstruction belongs here, but in the many cases of arrested labor

with maternal exhaustion some mechanical hindrance is present, and therefore such cases belong in the next subdivision. (2) *Anomalies of resistance:* Rigidity and stenosis of the lower birth tract and contracted pelvis make up this category. If the natural forces cannot overcome the obstruction, the forceps is used unless contraindicated. (3) *Fetal dystocia:* Here belong such anomalies as occipito-posterior and deep transverse cranial positions, face presentations, arrest of after-coming head in breech cases, etc. (4) *Miscellaneous:* Here belong all severe non-mechanical complications of labor requiring its immediate termination: Hemorrhage, rupture of the uterus, eclampsia, and accidental complications; severe acute or chronic disease occurring intermittently. But the use of forceps is not inevitable in these cases. In 208 high, median, and low forceps operations, I found the most frequent indications for its use were uterine inertia (75 cases); pelvic deformity (68 cases); persistent occipito-posterior position (41 cases); and to hasten labor in face and brow presentations and eclampsia.

Prerequisites and Contraindications.—(1) The cervix must be fully dilated. If the os is but partly open, resort to forceps will mean extensive injury to the cervix both from the instrument when applied and from the head when it traverses the os. The lesions thus produced in the cervix may bleed profusely. If, however, there is a very urgent indication to end labor quickly, a narrow margin of undilated cervix may be incised or dilatation may be completed with the fingers as a preliminary to employing the forceps. (2) The membranes must be ruptured. If the forceps were applied to the head with membranes intact, the entire ovum would come away with probable detachment of the placenta. In delayed rupture it may be necessary to incise the membranes in order to apply the forceps. Cases may arise in which it is by no means easy to determine the condition of the membranes. Thus, a caput succedaneum may be mistaken for a bag of waters. The distinction is usually made by the presence or absence of hair, but in some cases it is necessary to use a speculum. (3) The greatest circumference of the head must have passed the inlet and the head must be fixed in the pelvis. A head movable at the brim constitutes a contraindication to the use of forceps. Such a head must either be made to engage by external manipulation or the labor must be completed by version. (4) Generally speaking, the forceps requires the presence of a due proportion between the head and pelvis. The latter must not be too narrow. A living child cannot be born in a pelvis with a conjugate of less than 2.95 inches (7.5 cm.), and even in this degree of contraction a forceps could hardly be applied save to a very small and plastic head. Hence the conjugate should measure at least 3 inches (7.15 cm.). The forceps should not be applied to an over-large or hydrocephalic head, nor to an anencephalus. (5) The fetus should usually be living if forceps is to be used. In case of a dead fetus perforation could be more safely done.

Prognosis.—Very much depends upon the state of the mother at the time of operation. If the pulse is slow and full, the woman's condition may be pronounced good, even if the temperature is above normal. A rapid, low-tension pulse, on the other hand, is somewhat unfavorable because puerperal infection usually begins in this manner. Fetor of the vaginal secretions sometimes announces the existence of sepsis developing intra partum. Before undertaking the high operation in contracted pelves we should examine the cervix in regard to the possibility of abnormal stretching, which may precede a rupture of the uterus. Whatever goes wrong in connection with forceps extraction will be laid at the door of the operator unless he informs the relatives in advance

of the possibility of this or that accident. If a colleague is called in for consultation, he too should be fully informed in this respect. If the forceps is applied before the os is fully dilated, lacerations of considerable extent may occur in the cervix with more or less hemorrhage, which require suture immediately after delivery. Sometimes in the absence of complete dilatation a portion of the cervix is grasped in the forceps and torn off during extraction. The vagina has been injured in many ways through use of the forceps. The posterior fornix has been perforated. In locking the blades a portion of vaginal mucosa may be included. The forceps very seldom contributes to the production of a vesico-vaginal fistula, which is generally due to the condition for which the instrument is applied. Contusions are caused by to-and-fro movements which are permissible only when lateral and of small excursion; by forcible attempts at rotation; and, finally, by improper traction in the high operation. Slipping of the forceps is always a serious accident. It may result from incorrect application of the blades or from uncontrolled traction. The perineum is always ruptured when the forceps slips in the low operation, and extensive lacerations of the vagina may result from slipping higher up. The majority of cases of acquired stricture of the vagina are due to forceps injuries. Improper traction is another source of maternal traumatism. The high operation occasionally gives rise to peroneal paralysis through compression of the lumbosacral nerve as it crosses the pelvic brim; and among injuries to the bony pelvis which thus originate may be mentioned dislocation of the coccyx, rupture of the symphysis, and loosening of the sacro-iliac synchondroses. (Page 615.) The various forms of traumatism which have just been enumerated are almost all preventable if the forceps is properly used. After forceps delivery there is more or less atony of the uterus with the likelihood of hemorrhage. When the child is extracted with forceps, the conditions are somewhat similar to those of precipitate labor, which perhaps explains the presence of uterine atony under these circumstances. For a consideration of the forceps injuries of the child, see sections on Fetal Birth Traumatisms, Asphyxia, etc. (Part IX, pages 812 and 823.) I found in 208 forceps operations that 193, or 92.34 per cent., of the children were delivered alive; 11, or 5.26 per cent., were still-born; 1, or 0.47 per cent., died in the puerperium, and there was no record in 4 cases (compare Version, page 919). Podalic version was attempted in one case of prolapsed cord.

TECHNIQUE.

Preparation for the Operation.—The preliminary steps in a forceps intervention are antisepsis or asepsis, and the necessary arrangement of the patient upon a bed or an operating table. The indication for the application of forceps may arise so suddenly that but little time is available for preliminaries, which must therefore be quickly performed. Much of the antiseptic regimen should have been in force as part of the management of labor itself. The additional precautions are as follows: The forceps must be quickly sterilized by boiling, and if there is no time for this the forceps must be "fired" by being passed repeatedly through an alcohol flame of sufficient size. This is readily accomplished by saturating a small piece of absorbent cotton with alcohol and allowing it to burn on an ordinary dinner-plate. In a case of low operation in a multipara no other instrument will need to be sterilized. In case the obstetrician is not already prepared to meet post-partum hemorrhage and perform immediate suture of extensive lacerations,—and this lack of precaution is, of course, un-

avoidable under many circumstances,—all the material requisite for such emergencies should be made ready and freshly sterilized. Vaginal disinfection, held by many to be undesirable in normal labor, is indicated in forceps extraction. Everything should be in readiness to reanimate a still-born child. The woman can be placed in the lithotomy position across the bed, but it is preferable in all operations to press into use the kitchen or other table and properly equip it with sheets, Kelly pad, and pail for drainage. The extremities may be held by leg-holders (Fig. 1079), by the sheet sling, or if necessary by assistants. The light should fall upon the vulva. The urine must be drawn with a sterile catheter, a somewhat difficult procedure when the urethra is compressed by the head in the excavation. If a catheter cannot be made to enter, it will be necessary to forego the act until after delivery. A suprapubic examination of the bladder should always be made, however, because if the viscus is distended it may simulate that thickening of the upper segment of the uterus which implies that the lower segment is thinned to the extreme. Such a condition of the uterus is produced in labor with contracted pelvis, and is a threat that rupture of the lower segment may occur. If the suprapubic tumor disappears when the urine is drawn, the operator need have no fear of this accident. If feces have accumulated in the rectum since the beginning of labor, they should be removed by an enema. In regard to anesthesia, it is hardly required in the low operation in multiparæ. Aside from this, incomplete anesthesia may be recommended in easy extractions, and full surgical narcosis in all high and especially difficult cases. The anesthetic should be given by a colleague who has had experience. In rural practice the question of anesthesia is often very difficult to decide. There is no time to summon trained assistance, nor can the administration of chloroform be left to a novice. Under such circumstances the operator must choose between no anesthetic and partial anesthesia. In these cases when no assistant is at hand the woman should be etherized as deeply as appears necessary, and a novice quickly instructed in the use of the cone and the amount of ether to be used. An Allis inhaler is invaluable for such purposes. From the operator's position in front of the vulva the patient's face and respiration should be watched. Should cyanosis develop, he may be forced to leave the forceps, draw out the patient's tongue, and resort to the Sylvester method of artificial respiration.

Action of the Forceps.—The functions performed by the forceps comprise (1) traction, (2) compression, (3) rotation, (4) leverage, and (5) reflex stimulation of the uterus, or oxytocic action. This is the classification in vogue at the present day. Skutsch and a few other authorities would eliminate compression and rotation, so that, according to them, the instrument has but three distinct functions. (1) *Traction*, which is applicable to head and breech presentations only, and aids the natural forces of the uterus and abdominal muscles to expel the child. (2) *Compression*, enumerated among the functions of the forceps, is admitted to be a source of danger to the child and a meddlesome interference with head-moulding. For such a purpose it is never indicated, and its production is unintentional —an unavoidable evil. Only enough compression is indicated for the blades to hold firmly. In extracting, therefore, the instrument should be grasped near the lock, for if held by the tips of the handles the blades will be approximated to an unnecessary degree. This advice is especially to be heeded when the forceps is applied obliquely. The belief was formerly prevalent that in the application of forceps at the inlet compression was necessary to cause the engagement of the head. This originated from the fact that as the head entered the excavation the handles could be seen to approach each other, showing that the blades were

compressing the skull. This explanation, however, is false. The head following the natural descent—even in the presence of the forceps—presents certain of its smaller diameters in succession, and the forceps in adapting itself to them causes the approximation of the handles. While slight forceps compression may be without effect on the fetal head, the results of forceps delivery in contracted pelves show that in most cases it causes a great variety of cranial and endocranial lesions, to say nothing of the part it plays in causing asphyxia. (3) *Rotation* is classed as a function of the forceps. While available in certain conditions (see treatment of occipito-posterior positions, page 999) in the hands of an expert, it is a source of danger in other circumstances, menacing the maternal parts as well as the fetus. Many authorities eliminate it completely from the list of functions, stating that in the great majority of cases rotation is not an independent act but is brought about by simple traction. (4) *Leverage* was once applied more freely than at present. Its principal use to-day is in cases in which the head is advancing with unusual difficulty, when traction may be varied by horizontal to-and-fro movements. The axis of the forceps should not depart more than 30 degrees from the median plane of the pelvis. To-and-fro movements in the vertical direction are strictly contraindicated, as the maternal passage may readily be injured. The movement of the forceps in delivering the head is not leverage but simple traction. (5) The *oxytocic or reflex action* of the forceps upon the uterus is manifest when the instrument is adjusted to the fetus after a period of uterine inertia. Even the application of a single blade may be sufficient to revive uterine action, and the uterus in some cases is sufficiently stimulated to finish the labor without further aid. If the blades are cold, the oxytocic action is still more marked. It is needless to state that no one ever applies forceps solely for the sake of stimulating the uterus.

Classification.—The usual classification of simply high, median, and low operations is defective and unsatisfactory for the student, since it confuses two very different operations, namely, the high and median, and takes no cognizance of the two widely differing varieties of the median operation, for in this last variety the presence of an undilated or unretracted cervix is an element of great importance in the prognosis and treatment. The classification adopted in this work is as follows: A *high operation* is one in which the presenting part is still above the pelvic inlet, a maximum circumference, such as the occipito-frontal in vertex presentations, not having passed the plane of the inlet. A *median operation* is one in which a maximum circumference of the presenting part has passed the plane of the pelvic inlet. We should recognize two important varieties of median operation; *first*, those cases in which the ring of the cervix has only partially retracted over the presenting part, the latter being practically within the uterine cavity (Fig. 1205); and, *second*, those cases in which complete retraction of the cervix over the presenting part has occurred, the head resting in the vagina below the ring of the cervix (Fig. 1205). A *low operation* is one in which the presenting part is at or in the vulva.

Cephalic Application (Figs. 1207, 1209).—The preferable method is to apply the blades to the sides of the head, thus making compression in the biparietal diameter, where it does the least harm and where the least room is required for the blades, and more closely imitating the natural mechanism of labor. If the occiput is to the left and anterior, the fingers of the right hand are passed into the vagina through the cervix if it has not completely retracted, and the left blade is passed under the guidance of the left hand well up into the space between the head and the left sacro-iliac synchondrosis, and held there by an assistant. The right blade is now passed up in the same manner

between the head and the right side of the pelvis wherever there is the most room. This will usually be near the right sacro-iliac synchondrosis. It is then gently urged forward along the right lateral wall of the pelvis until it occupies a position near the obturator foramen opposite its fellow or over the right ear of the fetus. This may be done by means of the fingers in the vagina, by depressing the handle, rotating it on its long axis and carrying it to the left (Fig. 1207).

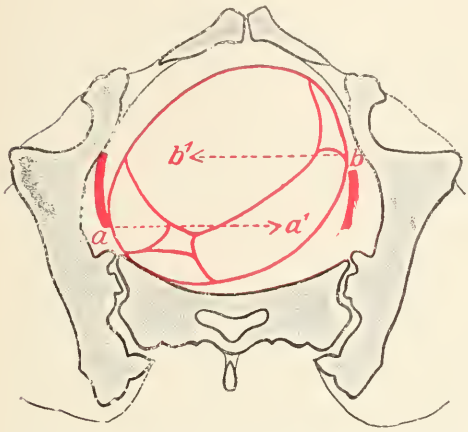


FIG. 1206.—PELVIC APPLICATION OF THE FORCEPS. *a*, *a'*, Pressure exerted by lower edge of the right blade upon the fetal skull; *b*, *b'*, pressure exerted upon the fetal skull by the upper edge of the left blade.

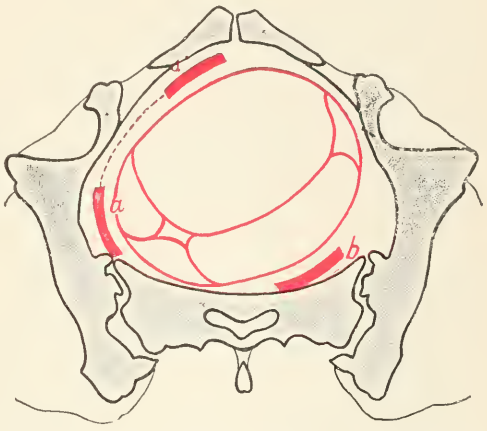


FIG. 1207.—CEPHALIC APPLICATION OF THE FORCEPS, OR ADAPTATION. *b*, Left blade. The right blade is introduced opposite the right sacro-iliac synchondrosis at *a*, and carried with the internal fingers to *a'*.

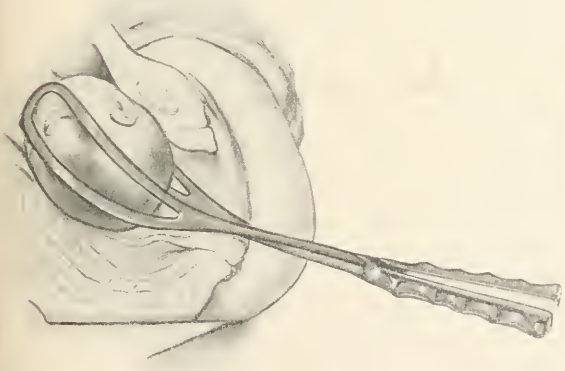


FIG. 1208.—PELVIC APPLICATION OF THE FORCEPS.

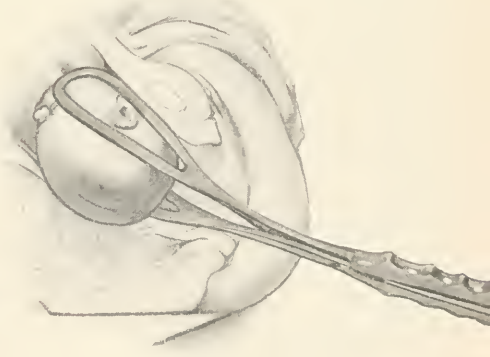


FIG. 1209.—CEPHALIC APPLICATION OR ADAPTATION OF THE FORCEPS.

This is termed adaptation of the forceps to the biparietal diameter of the fetal head. The second method—namely, the pelvic application—is perhaps the safest, especially for beginners. If the cervix is not completely dilated, it should be digitally dilated, and care must be taken, in guiding the tips of the blades through the cervix and in bringing the right blade forward, that its concavity is carefully left in contact with the fetal head. The blades now hold the head in its biparietal

diameter and tractions are begun. Artificial rotation is usually unnecessary, and should be avoided by beginners. Traction should at first be somewhat downward and backward according to the height of the head; the operator endeavoring to make traction with reference to the axes of the different pelvic planes through which the head must pass. If the head is in the upper part of the cavity, it may be easier to pass the anterior blade first, as in the high operation.

Pelvic Application (Figs. 1206, 1208).—In this case the forceps is applied as in the low operation and the head is seized with one blade over the temple and the other over the parietal protuberance of the opposite side. After the head has rotated the forceps is removed and reapplied to the sides of the head. If the handles are loosely held, the head may rotate between the blades. During the passage of the head through the cervix undue haste must be avoided and the head allowed to advance and recede in imitation of the natural process of dilatation. A finger placed upon the cervical margin from time to time gauges the amount of tension. A finger between the head and the symphysis pubis will also show how much force is wasted in pulling against the symphysis. It should be the aim of the operator to keep the head closely applied to the anterior pelvic wall, but without pressing it against the symphysis. The operator should loosen his grasp occasionally during a pain and see that he is not opposing rotation. The direction taken by the handles during a pain may serve to guide him. If the head is in the upper part of the cavity, the axis-traction forceps should be preferred, its skilful use improving the prognosis for both mother and child. If only the ordinary forceps is at hand, good results can usually be obtained, and one hand may be used as a fulcrum in the manner described in the high operation (page 997). In case of disproportion in size between the head and the upper part of the pelvis, the Walcher position will be of service in increasing the conjugate diameter and aiding engagement (page 870, Part X).

Low Operation.—In extraction under the simplest circumstances with the head on the pelvic floor in the first vertex position, normal rotation having occurred, the technique is as follows:

Introduction of the Left Blade.—The left blade is held with the left hand like a sword in fencing, with the thumb at the inner aspect of the handle, the three last fingers on the outer surface, and the index hooked over the flange-like projection at the distal end (Figs. 1210 and 1211). The right hand assists the introduction by guiding the blade into the left side of the pelvis, and at the same time protecting the maternal and fetal structures (Fig. 1212). This work is done by the index and middle fingers introduced into the left side of the pelvis as far as the child's ear and also paves the way for the forceps between the fetal and maternal parts. The thumb, strongly abducted, lies in front of the left labium majus. The handle is now elevated until it lies opposite the right groin and the tip of the blade is introduced into the vaginal entrance between the fingers of the right hand and the fetal head, on the left side of the pelvis. The concave side of the blade is, of course, turned toward the fetus. The handle is now gradually depressed until it is almost horizontal, and at the same time is carried somewhat toward the patient's left. This movement carries the tip of the forceps, protected by the two fingers, in a gentle curve about the head. The border of the forceps slides along the thumb, from which it derives its direction.

Introduction of the Right Blade.—The right blade is introduced in the same way, except that the movements are reversed and that the presence of the left blade makes the introduction of its fellow somewhat more difficult. The utmost gentleness is to be used in the foregoing movements; force is not allowable.

The right hand now holds the right blade while the first two fingers of the left hand are introduced into the right side of the pelvis preparatory to the introduction of the right blade (Fig. 1213). After the introduction of the right blade both blades are held for a moment by the right hand while the left hand is withdrawn from the vulva. If a blade cannot be introduced at first, it should be withdrawn and a second effort made. To facilitate the introduction of the right blade an assistant holds the handle of the left blade down and to the side. All efforts to introduce the blades should be suspended during a uterine contraction.

Locking.—After both blades have been properly introduced they should lock without difficulty. This is accomplished by taking a handle in each hand (Fig. 1214). Sometimes one blade is introduced further than the other, or the blades may not be exactly opposite each other, and slight movements of adjustment may be necessary. Difficulty in locking may indicate that the head has been seized transversely or obliquely, in which case the instrument should be removed and reapplied if possible; or it may indicate some complication, *e. g.*, an occiput posterior position or hydrocephalus.

Test Traction.—The instrument is now grasped, the lock by the right hand with the thumb underneath and the middle finger in the angle of the two blades (Fig. 1215). The left hand is now placed across the right at a right angle, with the left index finger pointing forward at the site of the small fontanelle; in this position gentle trial tractions are

FIG. 1210.—THE CORRECT MANNER OF HOLDING A BLADE OF THE FORCEPS.

FIG. 1211.—INCORRECT MANNER OF HOLDING A BLADE OF THE FORCEPS.

begun. The finger against the fetal head informs us whether the fetus follows the traction and also detects slipping.

Method of Making Traction.—Tractions should be made by the use of the arms and forearms, never by the weight of the body (Fig. 1216). They should be made in imitation of nature during the pains, or, if these are absent at regular intervals, they should be intermittent, each traction lasting not more than one minute. The aim should be to cause intermittent, alternate advance and recession of the head, as in natural delivery. All haste and excitement should be avoided. During the intervals between the tractions the handles should be loosened in order to limit the compression of the fetal head.

Direction of Traction.—In every case the presenting part should conform with the mechanism of labor. The traction should be downward until the external occipital protuberance is beyond the symphysis pubis. It is then made in a forward direction, and as the occiput becomes visible it is gradually changed until the handles are brought directly upward (Figs. 1217 and 1218).

Extraction of the Fetus.—When the small fontanelle is visible, the left hand is removed from the right in order to protect the perineum. Traction is continued until the nuchal region is in relation with the pubic arch; this contact

being determined by the distance between it and the fontanelle. At this stage of expulsion the right hand raises the handle until it almost rests upon the abdomen and the head is born. The blades are now separated by the fingers. It is usually advisable to remove the blades before final expulsion of the head in order to lessen the stretching of the vulva and the risk of laceration. The mechanism of labor may be aided during perineal dilatation by alternately flexing and extending the head with the forceps, the handles being depressed just as the external occipital protuberance clears the pubic arch in order to produce complete flexion. The head may then be delivered at the pleasure of the operator, or whenever he may think that sufficient perineal dilatation has been secured. When the head is about to be delivered, many prefer to remove the forceps and complete the delivery without it. This is advisable if the adaptation is very close; *e. g.*, in primiparæ. If the forceps is removed too soon, the head is apt to slip back into the vagina. Many authorities advise the

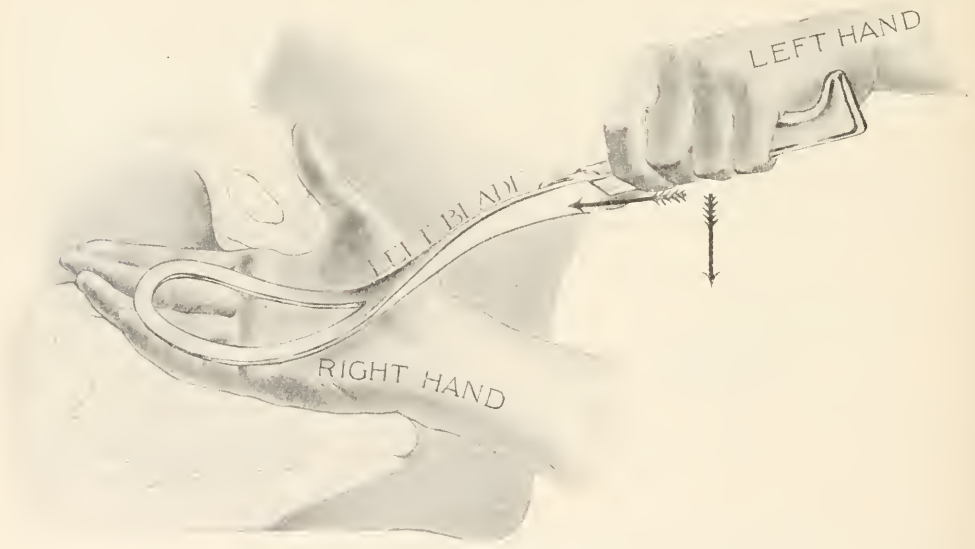


FIG. 1212.—INTRODUCTION OF THE LEFT BLADE OF THE FORCEPS.

introduction of the finger into the rectum in order to catch the child by the chin, but it is better to keep the head in place when possible by pressure upon the fundus or with a finger on each side of the coccyx (Fig. 1218). Intrarectal manipulations are always to be avoided as far as possible, since they are not conducive to asepsis, and even a careful use of this method may injure the eyes of the child.

General Principles.—The left blade is applied first because of the construction of the lock. Two fingers suffice for guiding the forceps only when the head is very low and when the margin of the os cannot be felt; otherwise four fingers should be employed. Great care is requisite lest the cervix be mutilated in the grasp of the forceps. While the fingers guide the forceps in front, the thumb performs the same function from the rear. Naturally an attendant could be of assistance in the introduction of the instrument. All force is contraindicated in the introduction of the blades. At times there is difficulty in locking the instrument because the handles are not in the same plane. If the deviation is

slight, they may be depressed a little, locked, and then elevated; but if it is considerable, it is evidence that at least one blade has not been properly introduced. In ideal forceps delivery the blades should be adapted to the convexity of the parietal bone. Under these circumstances the handles are almost perpendicular to the sagittal suture. When they stand apart and cannot be locked, an effort should be made to determine which blade is at fault by comparing the direction of the handle with the suture. The difficulty detected, the blade must be readjusted. but it is not always necessary to remove it. If simple

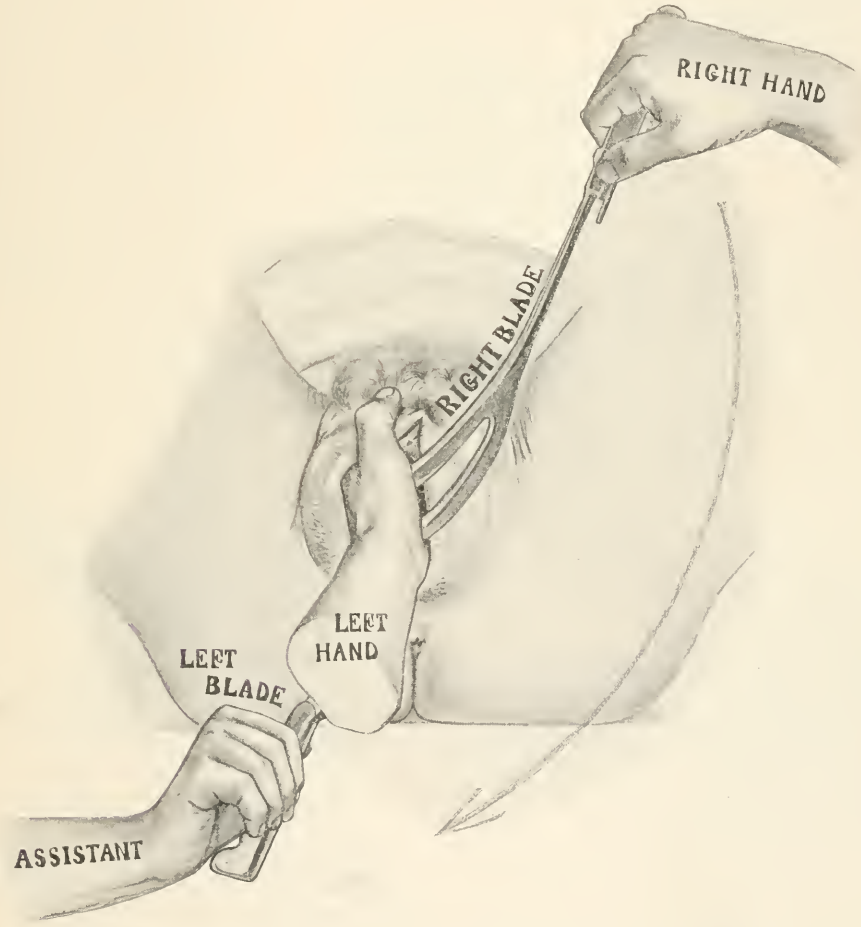


FIG. 1213.—INTRODUCTION OF THE RIGHT BLADE OF THE FORCEPS.

traction with the hand crosswise over the lock is ineffective in moving the head, light lateral movements, to-and-fro, may be made. If this is unsuccessful traction may be made with both hands. Care must be taken not to compress the handles, for this means compression of the fetal skull. The direction of the traction should always be so ordained that the head describes movements identical with those of natural labor. We must not attempt to use the forceps as a lever at the time of the expulsion of the head; the handles should be raised during gentle, steady traction. To apply the principle of the lever would be to

brace the forceps against the symphysis, which has been known to lacerate the venous plexuses by the side of the clitoris, while at the same time the posterior margin of the blades may cut the posterior wall of the vagina. The forceps occasionally slips or even comes entirely off. This may occur in two forms: (1) Horizontal, (2) perpendicular. In the former the blades slip over the sinciput or occiput, while in the latter the tips of the blades are pulled across the head in the line of pull. When the hands are crossed over the lock of the forceps, the index of the left hand is able to estimate the relations between the pull and the advance of the head.

Median Operation.—Here, since rotation of the head has not occurred, the

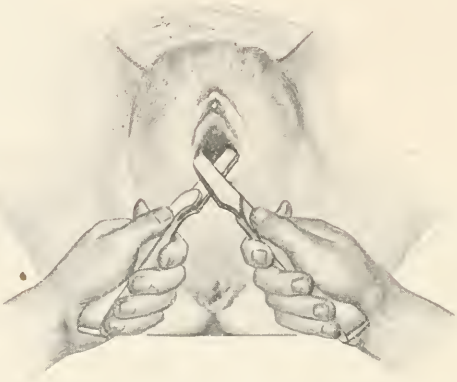


FIG. 1214.—LOCKING THE BLADES OF THE FORCEPS.

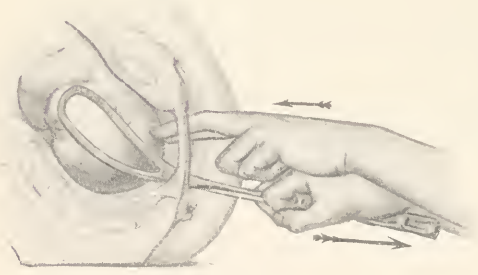


FIG. 1215.—TEST TRACTION.

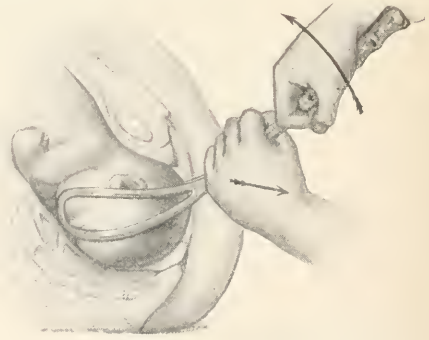


FIG. 1216.—METHOD OF MAKING TRACTION IN ANTERIOR POSITIONS OF THE VERTEX.

sagittal suture lying in an oblique pelvic diameter, there are two methods of operating. First, the forceps blades may be applied with relation to the sides of the pelvis only,—this is the pelvic application (Figs. 1206, 1208); second, they may be made to correspond or adapt themselves to the sides of the fetal head,—this is the cephalic application (Figs. 1207, 1209). The latter procedure or adaptation of the forceps should always be aimed at, and, after practice and attention to the mechanism of labor, can always be accomplished. Cephalic application secures a better prognosis for both mother and fetus by lessening the amount of traction necessary for extraction, the amount of pressure to secure a firm hold on the presenting part, and the danger of ruptures in the genital tract. (Compare Rotation, page 1002.)

High Operation.—This operation should invariably be done under anesthesia. The patient is put in the exaggerated lithotomy position on a table of sufficient height. The operator is at a great disadvantage if the level is low, because in making the necessary downward traction he would be compelled to kneel. The buttocks should be at the edge of the table.

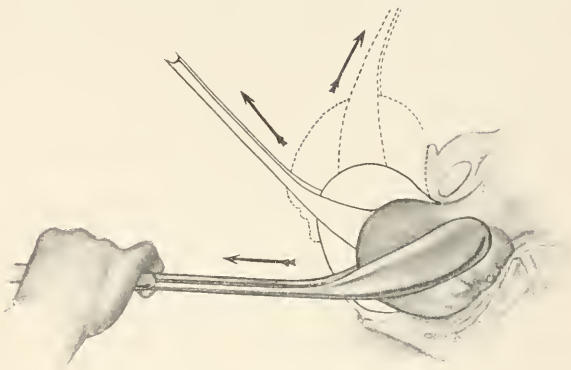


FIG. 1217.—DIRECTION OF THE TRACTION IN ANTERIOR POSITIONS OF THE VERTEX.

Ordinary Forceps.—The operation is performed with the ordinary forceps as follows: The blades should be applied in the transverse diameter of the inlet, therefore at the occiput and sinciput respectively, for the head at the brim should usually not be seized otherwise. The left blade is introduced in the hollow of the right hand into the left side of the pelvis, and adapted by the aid of the fingers to the fetal head, great pains being taken to prevent the inclusion of the thin margin of the dilated cervix. The right blade is then introduced in similar fashion and the instrument is locked, strong pressure being made at the same time against the perineum. A trial traction is first made to see if the hold is satisfactory, the forceps being grasped over the lock by both hands, the right overlapping the first two fingers of the left (Fig. 1215). While the left hand makes traction in the direction of the handle, the right presses vertically downward over the lock (Fig. 1219). As a result the head is drawn past the brim. The pressure upon the lock is not transmitted to the head as such, but the right hand forms a fulcrum for the lock of the forceps and the action of the left hand carries the handle upward and the blades and fetal head downward into the pelvis. Traction should not be prolonged over a minute, and after every second traction an examination should be made. The fetal heart should also be watched, and if fetal death occurs the forceps should be detached and the head perforated. As the head enters the

FIG. 1218.—REMOVAL OF THE BLADES OF THE FORCEPS, AFTER DELIVERY OF THE HEAD.

pelvis the handles of the forceps are seen to rise. An examination should now be made to determine the position of the head and whether or not rotation has begun. If the head is turning, the handles are seen to approach each other. If, on the other hand, the head is still transverse, careful and slight anterior rotation of the occiput may be favored with the forceps. The head is then examined again. As soon as rotation is apparent, I advise in all cases removal and adaptation of the forceps to the sides of the head. The head may still persist in its high transverse position, and in that case the blades must be reapplied obliquely. It is not necessary to detach them, for each blade controlled by the finger may be slipped along the head to the locality desired. This accomplished, traction is made, while at the same time the occiput is rotated forward. The operation as described is very difficult, especially if the degree of pelvic contraction is considerable. The obstetrician may be compelled to use the entire strength of both arms. Excessive force, however, is to be deprecated, for the strength of one man is the limit in this direction. If still more force is necessary to pull the head into the pelvis, fracture of the cranial bones or intracranial hemorrhage will be certain to occur. If traction is made in the direction of the handles without depressing them, the force thus misdirected does not advance the child, but does make injurious compression on the anterior wall of the pelvis.

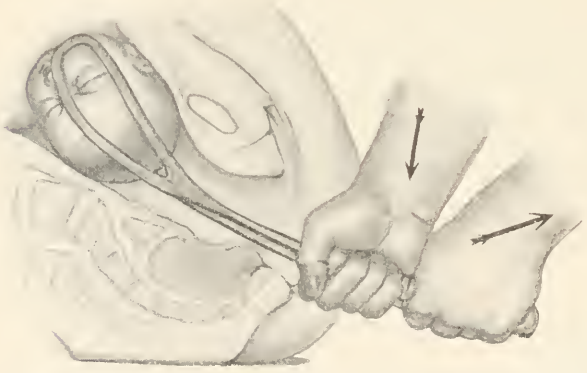


FIG. 1219.—THE PRINCIPLE OF AXIS-TRACTION APPLIED WITH ORDINARY FORCEPS. PAJOT'S MANŒUVER.

Axis-traction Forceps.—Since traction with the ordinary forceps when the head is high in the pelvis necessarily tends to pull the presenting part against the symphysis, numerous attempts have been made to overcome this difficulty. (1) Some obstetricians use one hand as a fulcrum for the shank of the forceps while the other hand seeks to tilt the fetal head into the excavation, in which situation it becomes amenable to ordinary traction (Pajot) (Fig. 1219). These manœuvers are described in full under the high operation. (Page 997.) (2) Another old method consists in attaching tapes, so-called traction strings, to the blades of the forceps, so that the traction force exerted by the operator would be more nearly in the axis of the birth tract (Poullet). (3) Still another device consists in using one arm of the forceps as a lever, the blade being passed between the fetal head and the symphysis, the latter serving as a fulcrum. A tape is attached to the blade, and while one hand makes the leverage the other performs traction (Farabeuf and Varnier). This principle, however, is best carried out by a traction rod attached to the blades of an ordinary long forceps which permits of automatic traction and leaves little or nothing to the judgment of the operator. The credit for the introduction of the accessory traction rod into obstetrics belongs wholly to Tarnier (Fig. 1220). Owing to a sharp bend in the shank of the rod, the "line of pull" actually passes through the pelvic floor, although traction in this imaginary line is intended only to carry the head into the excavation. An ordinary long forceps furnished with a two-armed traction rod constitutes the

axis-traction forceps as originally introduced by Tarnier. Numerous modifications of this principle are in use to-day. A further advantage of Tarnier's forceps is found in the movable joints formed at the insertion of the traction rod into the blades of the forceps, by virtue of which the blades are left free to follow the natural movements of the head (Fig. 1221).

Application.—The blades of the Tarnier forceps are applied like the ordinary instrument, the traction rods being grasped in the hand alongside of the shank. The traction handle is then adjusted, and the force of traction is exerted upon these handles with one or both hands (Fig. 1223), the handles proper of the instrument merely serving to indicate the direction the traction is taking.

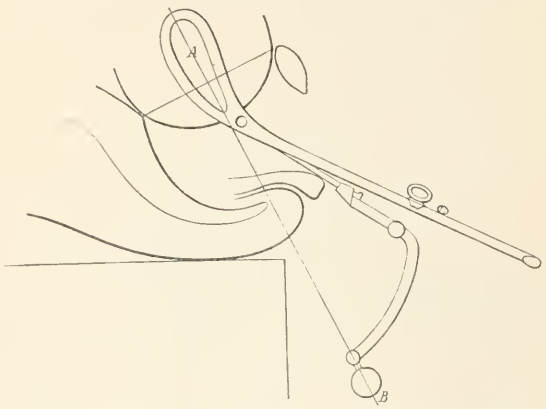


FIG. 1220.—THE PRINCIPLE OF THE AXIS-TRACTION FORCEPS. A, The blade of the forceps applied to the fetal head at the pelvic inlet. B, The traction rod at right angles to the handle of the forceps. A, B, The direction of the traction.

It is necessary for the success of the operation that the traction rods should be not more than half an inch (1.5 cm.) beneath the handles proper, and that the handle-bar of the traction rods should be always in a horizontal plane, no matter what the position of the blades may be (Fig. 1222). After the head has been drawn into the pelvis the handle-bar may be disconnected and the fetus extracted with the handles proper of the instrument, or the entire forceps can be removed and further extraction performed with the ordinary forceps.

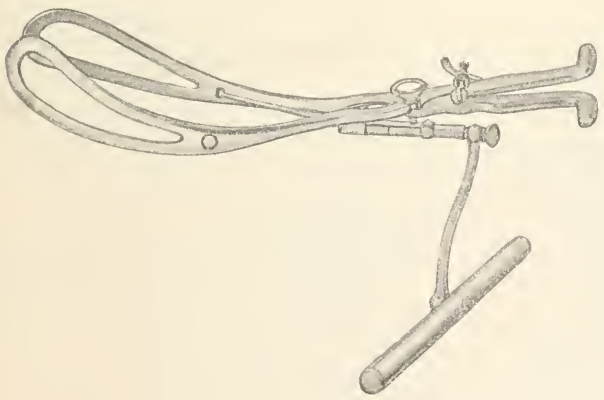


FIG. 1221.—TARNIER'S AXIS-TRACTION FORCEPS. LATEST PATTERN.

Occipito-posterior Positions.—The forceps is indicated in occipito-posterior positions only when the life of mother or child is threatened. The application of the forceps in these cases is much more difficult than in the physiological cranial positions. As the parietal eminences are seated somewhat more deeply than in the latter, the handles of the forceps are more nearly vertical when the blades are applied.

(1) *In high cases.* (The treatment of occipito-posterior position is used, page 545, Part V.)

(2) *In medium cases.* Should assistance be needed, the forceps will be called for. The head being well engaged, I am accustomed always to use the cephalic application of the instrument, namely, adapting the blades over the fetal ears.

When the forceps is to be used as a rotator, the cephalic in preference to the pelvic application should always be aimed at, as the prognosis for both fetus and maternal soft parts is more favorable. Downward traction should then be made in the proper axis until the head is brought to the pelvic floor. If in its descent there is a tendency on the part of the occiput to rotate about the shortest segment of the pelvis to the pubis, this rotation should be encouraged, but no marked rotation with the forceps as rotator should be made until the head has reached the levator ani muscle. An excellent instrument for this class of cases as well as the high ones is the last model of the Tarnier axis-traction forceps. The forceps is applied reversed (*inversion of the forceps*); namely, with the concavity of the pelvic curve toward the posterior part of the pelvis, and, of course, toward the occiput. Leaving the handles to take care of themselves, traction is made upon the traction rods only, and the swivel connecting these with the blades will allow of spontaneous rotation on the part of the head during its descent. Ordinary fenestrated or solid-bladed forceps will usually answer quite as well as the axis-traction ones (Fig. 1229).

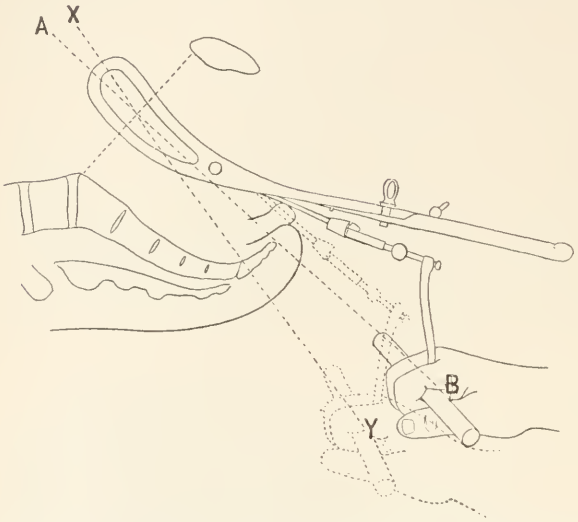


Fig. 1222.—Diagram Showing Traction with the Tarnier Forceps. A, B, In proper, and X, Y, in improper manner.—(*Ribemont-Dessaignes.*)

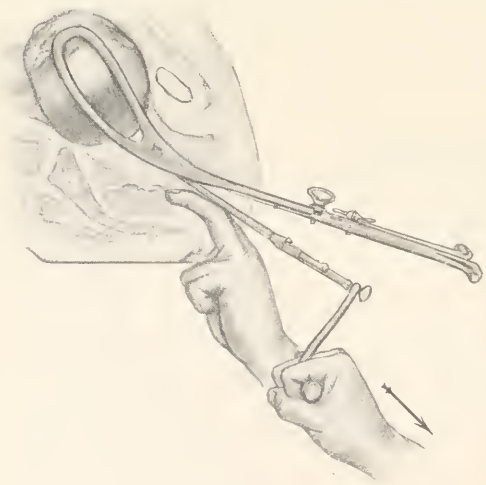


Fig. 1223.—Tarnier Forceps Applied to the Head at the Inlet. (There should be less space between the traction rod and shank of the instrument.)

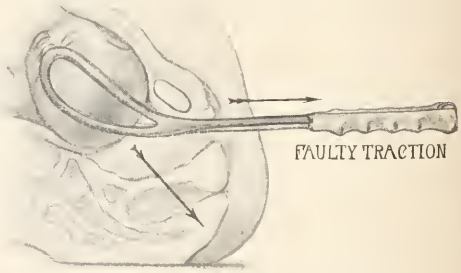


Fig. 1224.—Faulty Direction of Traction with the Ordinary Forceps.

Double Application of the Forceps.—Another valuable procedure in high arrest of an occipito-posterior position of the head, and which I frequently make use of, is what is known as the *double application of the forceps or Scanzoni's manœuver.*

First Step.—In the right occipito-posterior or most common occipito-pos-

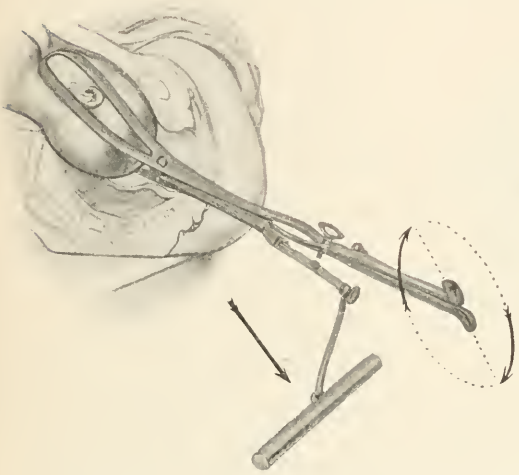


FIG. 1225.—DOUBLE APPLICATION OF THE FORCEPS IN OCCIPITO-POSTERIOR POSITION. FIRST APPLICATION.

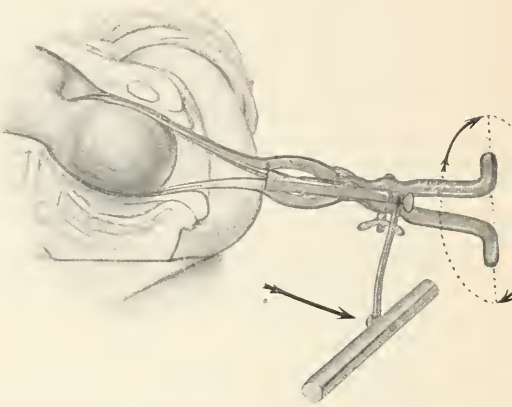


FIG. 1226.—DOUBLE APPLICATION OF THE FORCEPS IN OCCIPITO-POSTERIOR POSITION, SHOWING ROTATION OF THE HEAD INTO TRANSVERSE POSITION.

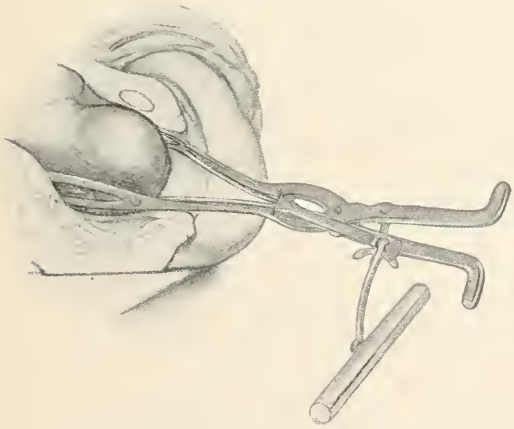


FIG. 1227.—DOUBLE APPLICATION OF THE FORCEPS IN OCCIPITO-POSTERIOR POSITION. Rotation into anterior position. Inversion of the forceps.

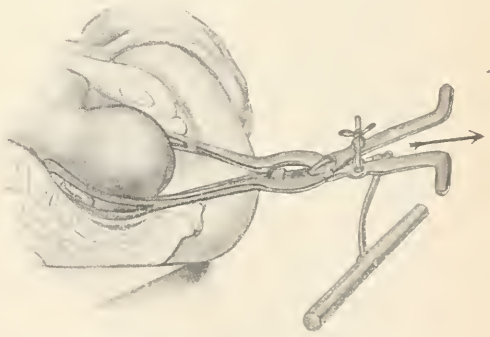


FIG. 1228.—DOUBLE APPLICATION OF THE FORCEPS IN OCCIPITO-POSTERIOR POSITION. SECOND APPLICATION OF THE FORCEPS.

terior position, the Tarnier instrument is applied, as if the case were one of left occipito-anterior, namely, with the pelvic curve of the forceps looking toward the left acetabulum and face of the fetus. The blades are adapted to the sides of the fetal head, the ears being used as guides. The lower or left blade is introduced first somewhat toward the hollow of the sacrum. The right blade is then introduced into the right side of the pelvis, and with the left hand along-

side of the head and the right grasping the handle, this blade is carried forward and upward until it rests over the left ear and opposite the blade already introduced (Fig. 1225).

Second Step.—Downward traction is now made on the traction handles until the head is brought to the pelvic floor, and then anterior rotation of the occiput is encouraged until the sagittal suture comes first into the transverse and then into the left oblique pelvic diameter. The forceps are now found to be inverted (Figs. 1226, 1227).

Third Step.—The forceps are now removed and reapplied as in the right anterior position of the occiput (Fig. 1228).

At this step in the operation I am accustomed to substitute for the Tarnier the ordinary forceps, and complete the delivery with the latter.

This method of treating persistent occipito-posterior of the head will often succeed when one has failed in the attempt to deliver with the ordinary forceps, or by first inverting the Tarnier instrument.

(3) *In low cases.* In operating, the usual conditions preparatory to any forceps operation should be fulfilled, and straight, fenestrated, or solid-bladed forceps may be used. I have used both the fenestrated and the solid-bladed forceps, and find that the latter has certain advantages in ease of application, rotation, and safety to the maternal soft parts not possessed by the former. This is particularly true of difficult cases. The straight forceps with no pelvic curve, such as Taylor's, is not necessary for the success of the operation. When the occiput is directly toward the sacrum and not opposite either synchondrosis, I am accustomed to reverse the forceps, applying it upside-down, so to speak, with the lock down and pointing to the occiput. In all cases adaptation of the instrument renders the prognosis more favorable for mother and fetus. The forceps being properly applied, our object should be always to keep the points of the instrument in as nearly the center of the pelvis as possible; always to combine rotation with downward traction; to rotate only in a very small segment of a circle during one traction; and, if uterine contractions are present, to time the combined traction and rotation with uterine action. During the intervals of uterine contractions the head should be held in the position obtained in order to allow the fetal body time to rotate also and accommodate itself to the new position of the head. Body rotation can be confirmed by abdominal palpation. In my experience abdominal palpation with a view to assist body rotation is of little, if any, advantage. If the forceps has not been reversed after the occiput has been rotated into the anterior segment of the pelvis, it will be necessary to remove and reapply the instrument if delivery is to be terminated at this time, which is the wisest course to pursue. If the forceps was originally reversed, this removal and readjustment is, of course, unnecessary.

Forceps as Rotators (Figs. 1229, 1230).—Much controversy has arisen over this question.* Many authorities claim that the production of rotation of the head by instrumental means through an arc of 180 degrees or even 90 degrees is attended by so much danger of producing lacerations of the maternal soft parts and injuries to the fetal head or neck as rarely to be justifiable. A careful study of the subject, and especially of the value of adaptation of the forceps to the sides of the fetal head, will convince any unprejudiced operator that with care and due regard to the mechanism of labor the operation is quite safe for both mother and fetus. For ten years the author has been using straight, fenestrated, and solid-bladed forceps as rotators in occipito-posterior cases, in tardy rotation of the head in vertex and face presentations, and of the after-coming head in breech extractions,

* Compare treatment of persistent occipito-posterior position, page 545.

and he sees no reason to abandon the procedure. The requirements for a good result in instrumental rotation are: (1) An accurate diagnosis of the presentation and position, obtained under anesthesia and by the introduction of the whole hand if necessary. (2) The cephalic application or adaptation of the forceps blades to the side of the child's head as early in the operation as possible. (3) A close imitation of the normal mechanism of labor in the case in question. (4) The combination of rotation and downward traction at one and the same time. (5) Most, if not all, of the rotation should be performed after the lowest portion of the presenting part has reached the pelvic floor, as in spontaneous rotation.

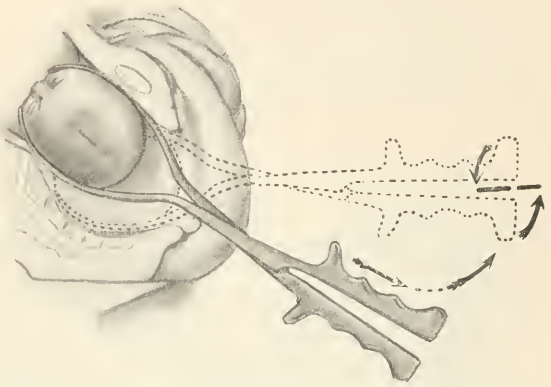


FIG. 1229.—ROTATION OF THE HEAD WITH ORDINARY FORCEPS.

Pelvic Presentations.—Skutsch does not even dignify this use of the forceps with a paragraph in his recent voluminous work on obstetric operations. Most authorities, however, continue to recommend it in certain conditions. Forceps appear to be indicated in breech cases before it is possible to use the finger or a fillet to produce traction. Jewett recommends Olliver's axis-traction forceps. If the breech is fixed transversely in the pelvis, the blades should be applied over the trochanters. Pressure over the iliac crests is held to be dangerous and, generally speaking, the entire procedure is calculated to cause more or less injury to the fetus. As the hold cannot be very firm,

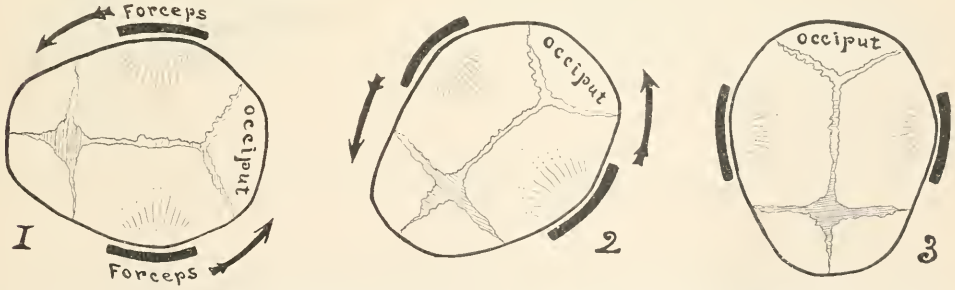


FIG. 1230.—ROTATION WITH THE FORCEPS. The head in 1 lies transverse in the pelvis, with the occiput to the left. The forceps is applied in the left oblique pelvic diameter, and the head is rotated (2, 3) from left to right until the occiput is anterior (3) and the forceps in the right oblique pelvic diameter.

traction must be slight and made only during pains, assisted by manual compression of the fundus. In my experience fetal traumatisms are frequent.

After-coming Head (Figs. 1231, 1232).—The application of the forceps to the after-coming head, formerly much in vogue, has been displaced gradually by various methods of manual extraction, which, being capable of continued improvement, have greatly benefited the chances for survival of the child. Therefore

it is not surprising that many obstetricians advise doing away with instrumental delivery in these cases altogether. A majority, however, are in favor of using the forceps in certain cases, although the indications appear to be much confused in most standard books. The forceps is indicated in but a very small proportion of cases of after-coming head. It is positively contraindicated when the head is above the brim, for if manual extraction is unsuccessful the head will probably have to be perforated, since the child will almost certainly be dead. The indications for the forceps are three in number. (1) The head is in the excavation with its long diameter antero-posteriorly or oblique, and, manual procedures having failed, immediate delivery is necessary to save the child's life. Experience has taught me that now and then a fetal life may be saved.

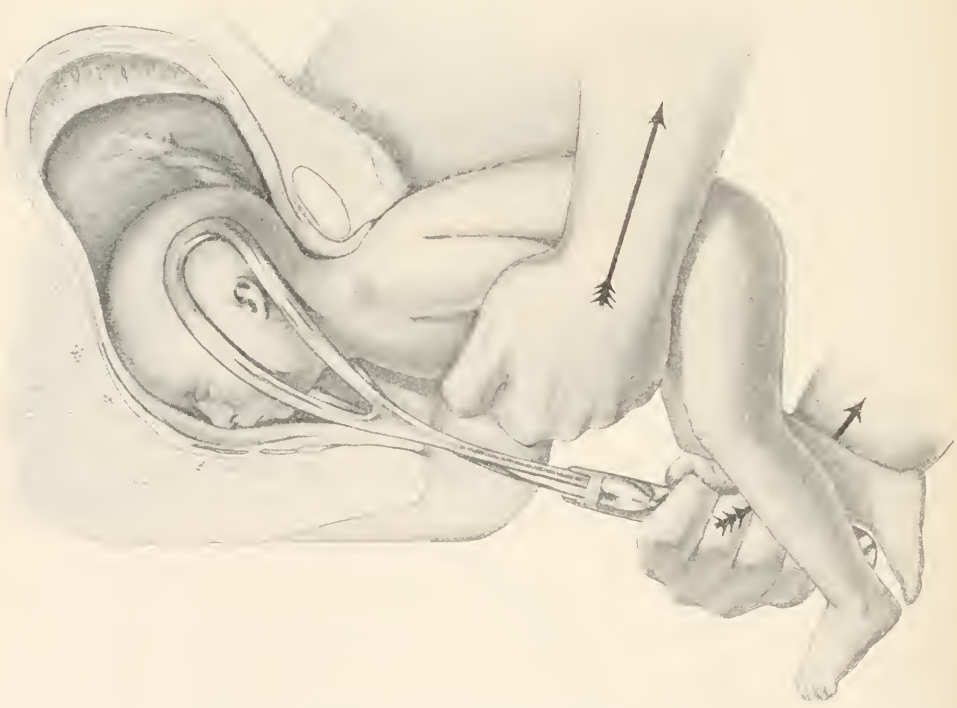


FIG. 1231.—THE FORCEPS APPLIED TO THE AFTER-COMING HEAD IN A SACRO-ANTERIOR POSITION.

(2) In abnormal rotation with the head extended, the face in front, and the chin over the symphysis. (3) In cases in which prolonged traction on the trunk threatens to rupture the child's neck. Such an accident might readily occur in a fetus long dead or in the presence of some disease. If the head is thus left behind, we have the condition known as detached head, to be described later. *Technique:* The general rule in vertex anterior cases is to apply the forceps below the child, which is lifted upon the mother's abdomen by the legs, care being taken not to stretch its neck. The arms are raised with the trunk; the forceps is applied in the usual manner, care being taken not to grasp the cord. Traction should be made in the direction of the handle until the chin appears. Thereupon the nuchal surface of the child should be made to rotate beneath the pubic arch, the handles being turned toward the mother's ab-

domen. I am accustomed to apply the forceps above the child in occipito-posterior positions, while others simply advise that the instrument be applied in the easiest manner possible and independently of set rules. *Detached head:* In breech extraction the head may be detached and left in the uterus by accident or design. In the former instance the mishap arises from decapitation of the dead child as a result of too forcible traction. In the latter case the head is left after deliberate decapitation. If attempts at manual extraction fail, the forceps may be applied, although cephalotripsy, if available, is the more rational course.

Face Presentations (Fig. 1233).—The general principle in the management of these cases is expectancy. There is no indication, from the position alone, to apply the forceps. Only when the life of mother or child is threatened should

FIG. 1232.—THE FORCEPS APPLIED TO THE AFTER-COMING HEAD IN A SACRO-POSTERIOR POSITION.

we resort to instrumental intervention. In mento-anterior positions with the face in the antero-posterior diameter, extraction should be easily effected. The handle of the forceps should be higher than in cranial occipito-posterior positions. If this point is overlooked, the tips of the forceps may compress the fetal neck. Traction should be made in the direction of the handle until the chin is born beneath the symphysis, the child's throat being in contact with the ligamentum arcuatum. The handle is now turned strongly upward toward the mother's abdomen, and the face, brow, vertex, and occiput are born in succession over the perineum. The forceps carries the head from its position of extreme extension to one of flexion. As the handle of the instrument arrives at the abdomen the task is finished and the forceps should be detached. If the mento-anterior face is in an oblique diameter, the forceps is applied trans-

versely unless the obliquity is extreme. Then, under traction, the head rotates normally. The oblique application is not contraindicated. In the second facial position, chin to the right, the left blade should be applied in front; in the second, chin to left, the right blade goes in front. In a deep transverse facial position the forceps is applied obliquely with the pelvic curve turned toward the chin. The conditions are analogous to forceps delivery in deep transverse head (page 1006). *Mento-posterior position:* In mento-posterior positions with the indication for immediate extraction the forceps is of no service and the head must be perforated. Scanzoni's method of rotating the head with the forceps must be condemned. Some obstetricians hold that the manœuver may be feasible in some cases in the hands of an expert, but it is rarely safe. The head is grasped at the sides, the forceps being applied obliquely with the concavity of the pelvic curve directed in front. The face is now rotated into the transverse position. The blades are then detached and reapplied in the

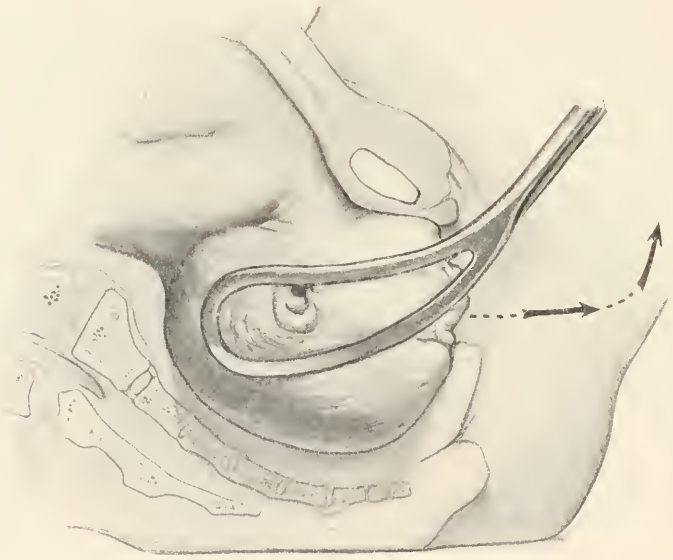


Fig. 1233.—Forceps in Face Presentation. Mento-anterior Position.

manner described for deep transverse face. (Compare Treatment of Mento-posterior cases, Part V, page 550.)

Brow Presentation.—The forceps should be applied as in bregma and face presentations with the handles relatively high in order to obtain the best possible grasp of the head. In making traction we should always be controlled by knowledge of the mechanism in these cases. We should pull in the direction of the handles until the root of the nose arrives at the ligamentum arcuatum. The handles are then lifted well up and carried to the mother's abdomen, while the vertex and occiput are born over the perineum. The handles are then brought down again, pressure being made at the same time with the hand on the brow, and the remainder of the face is delivered. There is therefore an analogy, from the standpoint of forceps delivery, between brow and occipito-posterior positions.

Deep Transverse Head.—There is no indication for the use of instruments in this position save immediate danger to mother or child. The forceps, in order to grasp the head over the parietal eminences, would have to be without pelvic

curve (straight forceps). If the ordinary instrument is used, the blades must be applied in an oblique diameter and the concavity of the pelvic curve must be turned toward the occiput. The latter is then rotated forward till the concavity of the forceps is turned to the anterior pelvic wall. If the occiput was on the left side of the pelvis, it rotates into the L. O. A., and vice versa. When the head is ready for extraction, the concavity of the side of the forceps must correspond with the curvature of the pelvic canal. Occasionally it happens that the mere locking of the forceps produces some rotation forward of the occiput, so that when the blades are brought into the transverse diameter the sagittal suture is found to be in the antero-posterior diameter. In this case as soon as the neck of the child reaches the pubic arch the handle is brought upright in the customary manner. If the small fontanelle is not brought to the middle line when the blades are in the transverse diameter, extraction must be accompanied by a slight degree of rotation.

VIII. THE SLING OR SOFT FILLET.

The sling, soft fillet, noose, fillet, or loop, as it is variously called, is occasionally used in obstetric manipulations, and could, I am certain, with advantage be much more frequently employed.

Indications and Actions.—The sling is used chiefly in cases of high arrest of the breech, and it should be noted that it has five distinct uses: viz., (1) As a tractor; (2) to prevent recession of the presenting part; (3) to facilitate manipulations by drawing the presenting part to one side; (4) to serve as an accessory when the simultaneous employment of both hands is forbidden by lack of space; (5) to prevent extension of the arm or arms.

FIG. 1234.—METHOD OF ADJUSTING A SLING TO THE FOOT.

Material and Carriers.—A yard of two-inch gauze bandage boiled and moistened with 1 per cent. lysol solution answers very well for a soft fillet. Another excellent fillet is a yard of one-fourth-inch rubber tubing through which a tape is passed, stitched to the side of the tubing, and allowed to project six inches at both extremities. In many cases fillets can be passed over the thigh with the index finger. This will often necessitate the passage of the whole hand into the vagina. A ready method is to take a No. 16 English catheter with stylet in place, and bend the end of the catheter into a hook of the shape of the ordinary blunt hook (Fig. 1109). A doubled piece of tape or bobbin is threaded into the edge of the catheter by means of the stylet, and the hook with the tape is passed over the thigh in the most convenient manner. The tape is then caught with two fingers or a pair of dressing forceps and the catheter withdrawn. The tape is now used as a sling to draw the desired fillet into position. Blunt hooks are often perforated with an eye at the extremity and used instead of the catheter. A fillet carrier or porte-fillet is a special instrument

made for the purpose. It is on the principle of Bellocq's cannula used by surgeons in drawing up a plug into the posterior nares. It is curved like the obstetric blunt hook and has a long piece of whalebone running through the canal.

In Pelvic Presentation.—Here the soft fillet is used as a tractor. In low arrest of the breech the hand usually proves the best tractor, and even in high arrest it is sometimes possible to pass a finger or several fingers into the flexure of the groin; when the hand cannot be used, we resort to the soft fillet or forceps. Traction with a single or double fillet, in impacted pelvic presentations, is a valuable means of extraction, much safer in the hands of most operators than the blunt hook or forceps, and a method of delivery, I believe, too seldom resorted to. Often in tardy breech expulsion the delay is caused by flexion of the fetal pelvis upon the trunk, and perhaps by extension of the legs alongside of or above the fetal head. Traction on one or both groins extends the pelvis, draws down the feet, and thus renders the passage of the breech through the parturient canal easier, provided no great disproportion exists between fetus and maternal pelvis. *Sling to one groin:* When a single sling is used, it should encircle by preference the anterior or lower thigh, and in the majority of cases a single sling is sufficient. I have in difficult cases combined the sling to the anterior groin and the protected blunt hook to the posterior (Fig. 1177). *Sling to both groins:* Unless too great difficulty is encountered it is preferable to pass a soft fillet over both groins, as by so doing the force of traction is more evenly distributed and there is less danger of injury to the soft parts and the heads of the femurs. *Sling encircling fetal pelvis:* Although it is difficult and often impossible to apply a fillet encircling the fetal pelvis, with the ends passing down between the thighs, it is the safest and most efficient way. The English advise the use of a soft handkerchief for the purpose, but a piece of four-inch gauze bandage a yard long, boiled and lubricated with a 1 per cent. lysol solution, answers better. A knot is tied at each end, and one knot is carried with the fingers, an English catheter, or a porte-fillet, on one groin from without inward, until the knot can be reached between the thighs and drawn down. In like manner the other end of the fillet is passed over the opposite groin from without inward, thus bringing both ends of the fillet down between the thighs. With the whole hand if

FIG. 1235.—ADJUSTING A SLING TO THE LEFT ANTERIOR LEG.

necessary in the vagina, the center of the fillet is adjusted up over the buttocks and around the fetal pelvis by an upward movement of the internal hand and downward traction on the two ends of the fillet with the external hand. The fillet is thus made to make traction on the external circumference of the pelvis, thus relieving the groins from the dangerous traction exerted by the other forms of fillet. It is not always possible to adjust this sling after the breech is firmly impacted in the pelvis, and even at the pelvic inlet it is at first difficult unless it has been repeatedly practised on the puppet and pelvis or manikin (Fig. 1176).

In Version.—It is especially in complicated internal version that the soft fillet finds its chief use (page 935).

Placenta Prævia.—It occasionally happens that a combined or internal version is performed in placenta prævia; one leg is brought down and the half breech used to tampon the partially dilated cervix. Under such circumstances the version is not always followed by immediate extraction, and in the mean while a soft sling to the prolapsed leg is a convenient way to keep up pressure on the placenta and prevent recession of the leg (Fig. 1080).

Prolapse of the Cord.—In like manner the sling may be used after version in prolapse of the cord to hold the half breech temporarily in the partially dilated cervix and thus prevent recurrence of the prolapse.

In Prolapse of an Arm in Shoulder Presentation (Fig. 1126).—In cases of version in shoulder presentation complicated by prolapse of an arm the sling is applied to the wrist and used to draw the arm forward and backward, thus making room for the passage of the hand into the uterus, and afterward to prevent extension of the arm and subsequent difficulty in extracting the head. In all cases care should be taken not to injure a fetal member by tying the sling too tightly or making traction too forcibly. Sawing movements should be avoided, since they may cause extensive laceration of the fetal parts. When the presenting part is high and difficult to reach, it is often convenient to pass the loop over the operator's arm. It may then be pushed up by a pair of long forceps or some similar instrument (Fig. 1128).

Combined Manipulation in Version.—When there is difficulty in turning in internal podalic version, in cephalic or shoulder presentation, by reason of the grasp of the uterus over the fetus, success may sometimes be obtained by attaching a sling to a foot and making traction on the foot by means of the end of the sling outside of the vagina, and at the same time, with the other hand in the vagina, making upward pressure upon the head or shoulder. Skilled assistance, by depressing the breech and pushing up the head externally, will greatly aid the manœuver (Fig. 1129).

Prophylactic Sling in Version.—It has been proposed, as a preliminary to internal podalic version, to fasten a sling on one or both fetal wrists *in utero*, the object being at all stages of the operation thus to keep both forearms below the chin and prevent extension of the arms. The procedure is a dangerous and an unnecessary one, for, although theoretically correct, the manipulation of the fetal thorax and umbilical cord will in many cases disturb the equilibrium of the fetal circulation and cause asphyxia by premature respiration within the uterus.

IX. THE BLUNT HOOK.

The blunt hook, made entirely of metal for aseptic reasons, about twelve inches long and with a semicircular curve at the end forming a hook the diameter

of which is two inches, is still a valuable and useful instrument in operative obstetrics (Fig. 1236).

Uses.—The use of the blunt hook should be confined principally, if not entirely, to the extraction of the dead fetus. It may be passed over the groin in breech presentation for traction, then over the brim of the fetal pelvis, and hooked into the ribs or over the shoulders or a humerus in difficult shoulder extraction. In the case of a living fetus the blunt hook should be used with the greatest care, if at all; the soft fillet or digital traction is usually to be preferred. On the living its use is principally confined to traction on the anterior or posterior groin or both in difficult breech extractions. It is not desirable to use this instrument on a living fetus unless all other methods of extraction fail, by reason of the injury to the fetal soft parts and to the head of the femur liable to follow its use. To avoid injury to the skin of the groin, the writer is accustomed to slip a piece of tightly fitting rubber tubing over the hook and shank of the instrument, sterilizing the whole before use. Wrapping the hook and several inches of the shank with a one-inch gauze bandage also answers very well in the absence of the rubber tubing. The blunt hook, thus protected, carefully and judiciously used, becomes a valuable instrument in impacted breech cases, but in the hands of the careless and inexperienced in its use it is capable of much injury to the fetus. It is advisable to pass the hook over the anterior thigh in breech cases, since this thigh is lowest and most readily reached. It is passed up lying flat against the thigh, with the hook pointing toward the anterior surface of the fetal ellipse until opposite the groin, the hook then being passed over the flexure of the thigh, care being taken to have the hook descend between the thighs and not catch on one thigh, to avoid damage to the femur and the femoral vessels. The proper adjustment is secured by digital palpation between the thighs.

Fig. 1236.—The Blunt Hook.

X. THE CROTCHET.

The crotchet was an instrument which in the days of craniotomy was used for the extraction of the mutilated head after the vault of the skull had been removed piecemeal with the craniotomy forceps. It is practically a sharp hook about ¾ inch in length with a suitable handle for traction. The instrument is now obsolete, but may be found among the collections of instruments in the older maternity hospitals, and upon inquiry at the three largest instrument-makers in New York I found the instrument was at first unknown, until reference was made to an illustrated price-list. Occasionally in the past ten years I have used the instrument in the extraction of a dead fetus, when fixed in an axilla, between the ribs, or any available part of the body. The blunt hook may be used in the same way. Originally, for extraction after perforation or craniotomy the hook was passed into the interior of the skull and moved about until a firm hold was secured upon the bones of the vault or sides of the skull. It was not intended, nor was it possible, to fix it in the foramen mag-

num, as is so often stated in the text-books. Quite another instrument, namely the vertebral hook, was used for that purpose.

XI. EXTRACTION OF THE FETUS MUTILATED BY EMBRYOTOMY.

Extraction of the fetus after (1) perforation (page 944); (2) cranioclasis (page 947); (3) cephalotripsy (page 951); (4) decapitation (page 955); (5) evisceration (page 960); (6) cleidotomy (page 961); and (7) spondylotomy (page 963), is described under the heads of these operations as above indicated.

XII. CÆSAREAN SECTION.

Definition.—The term Cæsarean section is applied to the operation also called in accordance with modern ideas of nomenclature, laparo-hysterotomy, which consists in the extraction of the child through an abdominal and a uterine incision.

Historical.—The derivation of the term Cæsarean is wrapped in some obscurity, but the best evidence seems to connect it with the name Cæsar, which in turn seems very likely to have its origin in the root of the verb "cædere," to cut. A form of the operation seems to have been known early in the history of Rome, and it is recorded that an ancient ruler of that city, Numa Pompilius, caused a law to be enacted requiring the operation on recently dead women far advanced in pregnancy so that mother and child might be interred separately. Certain tribes have likewise made it customary to remove the child even when there was no thought of its survival. Mediæval records of the operation are few and unsatisfactory, and of no great interest except historically. A case is recorded from Venetian sources in 1491, and somewhat later a Swiss peasant is said to have done the operation upon his own wife, though certainly not before death. Somewhat later, apparently, the possibility of doing the operation upon the living began to be discussed, and the question of how much risk the mother should be subjected to in order to save the child began to be argued. The first operation upon the living appears to have been done in 1610 by Trautman, though it is really only since the advent of antisepsis that the operation can be said to have assumed a recognized and important place among obstetrical procedures. The consensus of opinion always has been, and still is, that the life of the mother is more important than that of the child, and that the former should not be subjected to chances the favorable results of which accrue to a great extent to the latter. The field for Cæsarean section is therefore limited, though under modern conditions, with a proper selection of cases, the risks to the mother have been very greatly diminished and the operation has, in many instances, come into competition with embryotomy and symphyseotomy. The doctrine of the Roman Catholic Church has always been that it is a mortal sin to compass the death of the child in order to extract it, and among adherents of that faith this fact may sometimes have a bearing upon the choice of this operation in preference to embryotomy. The operation of embryotomy upon a living child at or near term is the most revolting thing which a medical man can be called upon to do, and whenever there is a reasonable prospect that the abdomen can be opened and the child thus removed with no greater risk to the mother than is incurred by any procedure which involves the sacrifice of the child, Cæsarean section may be undertaken. The earlier writers in the last half of the nineteenth century spoke very disparagingly of Cæsarean section and looked upon it as a last resort in desperate cases, a fact which explains to a great degree their almost uniform lack of success. When antisepsis came in, and when cases began to be properly selected, the proportion of successes began to rise, until at present it has reached a comparatively encouraging figure. The few instances in history in which prominent men are said to have been brought into the world by the abdominal route are not authenticated, and in all it is uncertain whether the mother was alive or dead at the time of the alleged operation.

Indications.—The indications for this operation are of two kinds—*positive* and *relative;* the former of which may be disposed of in a few words. Cæsarean section is positively indicated when the maternal or fetal dystocia is

so great that it is impossible to remove the fetus even after embryotomy. The relative indications for the operation are not so clearly marked. When it is evident that embryotomy can be done successfully and without great risk to the mother, the question in the presence of a dead child is easily decided, but if the child is alive the proper course is not so clear. The good results which have recently followed Cæsarean section have led many operators to consider that a conjugate of 3 inches (7.62 cm.) with the child living, and 2.76 inches (7 cm.) with the child dead, requires the operation. It is to be remembered that in cases in which the difficulty is due to a flat rather than a generally contracted pelvis, a shorter conjugate will suffice to effect delivery through the natural passages. In 1887 Lusk, of New York, declared that embryotomy in a greatly contracted pelvis was as dangerous to the mother as Cæsarean section, and that since the former operation always sacrifices the child, we should not wait too long before resorting to the latter when other means of delivery fail. These views have been substantiated by many later observers. We should remember that in rachitic dwarfs the indication for Cæsarean section is practically always present unless labor is induced at a very early date in the pregnancy, and if such patients are met with later we must anticipate the necessity of the operation. As a rule, Cæsarean section should be done at term, but it is not necessary to wait for labor to begin. A point in favor of the Cæsarean operation is that by it measures can be taken to prevent future conceptions by tying and dividing the Fallopian tubes. While pelvic deformity is the commonest condition which requires this mode of delivery, carcinoma of the cervix preventing dilatation and pelvic tumors of almost any kind may be the cause of the dystocia. Eclampsia and placenta prævia have sometimes been put down as conditions which may occasionally demand Cæsarean section; however, while it is conceivable that it might be advisable to do the operation in eclampsia, it is safe to say that placenta prævia will rarely demand it. The decision to operate must always depend to some extent upon the characteristics of individual cases, and experience alone will enable us to draw uniformly just conclusions, but the figures given above—a conjugate of 3 inches (7.62 cm.) for a living child and 2.5 inches (6.35 cm.) for a dead one—may be taken as correct in indicating the operation, barring special and unusual conditions. In cases in which the conjugate is over 3 inches (7.62 cm.), but still somewhat or considerably under normal, judgment is required to avoid extremes and decide between the comparative advantages of premature labor and symphyseotomy. We must not wait until the patient is so exhausted from shock, hemorrhage, or sepsis from absorption that she has no recuperative powers left. When we have concluded to operate, we have still to choose between Cæsarean section and the so-called Porro modification. Cameron has made about fifty patients sterile by dividing the Fallopian tubes between ligatures, and has had no bad results after the operation. This procedure must also be considered, since its success naturally removes a great future danger, and the theoretical danger of subsequent pelvic hematocele has not been encountered.

Prognosis.—The prognosis in Cæsarean section is yearly improving. I am unable, however, to give statistics that will cover all the different varieties of cases. So long as the results of operations performed in well-equipped operating rooms, with every convenience at hand, are included in the results obtained under unfavorable environment and with faulty assistance, so long will the statistics be misleading. We can state, however, that when the environment is favorable, when conveniences and competent assistants are at hand, when the mother is in good condition and has not been infected by repeated

examinations and unsuccessful attempts at delivery, and when the fetus is still strong and healthy in the uterus, the danger of Cæsarean section to the mother is almost *nil*, and we can assure the patient and her family that the child will almost certainly survive.

OPERATION.

Preparation of the Patient.—The preparation of the patient, emergencies excepted, is exactly the same as for any other laparotomy, with the additional precaution of cleansing the vagina by scrubbing and the use of alcohol and bichloride-of-mercury or lysol solution. In an emergency as much as possible should be done, and we can at least be sure of sterile hands, instruments, and dressings. Provision must be made for liberating the fetal head from below in case it has become firmly engaged in the pelvis.

Instruments.—The instruments required are few and simple. Plenty of artery clamps should be at hand, and these, in addition to a knife, scissors, dissecting forceps, needles, and needle forceps, are all that are required. Silk and catgut ligatures must be ready, and a number of good-sized needles already threaded with catgut for use in closing the uterine incision. The bladder should be emptied shortly before the operation is begun. Four assistants besides the operator are necessary—one to give the anesthetic, one to assist the operator at the wound, one to hand the instruments and ligatures, and another the sponges. Preparations must also be made for the resuscitation of the child if necessary, and a person versed in such methods should stand ready to receive and care for the child.

FIG. 1237.—CONTROL OF THE HEMORRHAGE IN CÆSAREAN SECTION BY THE HANDS OF AN ASSISTANT GRASPING EACH BROAD LIGAMENT.

Position of the Fetus.—The position of the fetus should previously be made out as accurately as possible, as with this fact before us it is often easier to extract the fetus.

Abdominal Incision.—The incision is made in the median line, five or six inches (12.7 to 15.24 cm.) long, usually with the umbilicus as its middle point. When the fundus stands very high in the abdomen, as it usually does in absolute pelvic contraction, the bulk of the incision is best made above the umbilicus, thus securing a high opening in the uterus. Very little bleeding occurs from the thin abdominal walls, and clamps should control any that takes place. After the abdomen is opened there are some variations in the technique. It

is advisable to be sure that the uterus is not greatly rotated on its long axis, and this fact can be ascertained by noting the position of the Fallopian tubes. The next step is the opening of the uterus, before which two important matters are to be attended to. These are the protection of the abdominal cavity and measures for the control of hemorrhage.

Protection of the Abdominal Cavity and Control of Hemorrhage.—The abdominal cavity is protected by the use of properly disposed gauze pads around the edges of the widely retracted wound, and by an assistant lifting the uterus firmly against the edges of the wound (Fig. 1237). The hemorrhage from the uterine incision was formerly controlled by a strong elastic ligature drawn right over the fundus and slipped down as low as possible and tightened, or, better, by the hands of an assistant, one grasping each broad ligament and by judicious pressure obtaining the same result, and at the same time steadying the uterus (Fig. 1237). These are unnecessary if the operation is quickly performed and are even dangerous by predisposing to subsequent uterine atony and hemorrhage.

Uterine Incision.—Two methods of procedure are now before the operator, namely, to open the uterus *in situ*, without delivering the organ through the abdominal wound, and the other to lift the uterus out of the abdomen before opening it.

The former plan should be pursued in all cases in which no infection is present, and the latter when by reason of previous repeated attempts at delivery we have reason to suspect infection of the uterus.

1. The abdominal cavity being protected by gauze pads, and by an assistant holding the uterus close up to the abdominal wound (Fig. 1237), the incision into the uterus should be made rapidly down to the membranes, and should be about 6 inches (15.24 cm.) long. If the placenta is met, it is separated and pushed aside, or even bored through with the fingers, but not cut.

2. Should we have reason to suspect that the uterus is infected, then before making the uterine incision, the organ should be lifted out through the abdominal incision, and not opened until we have thoroughly protected the abdominal cavity from infection from the uterine contents by placing around and behind the uterus sterile towels.

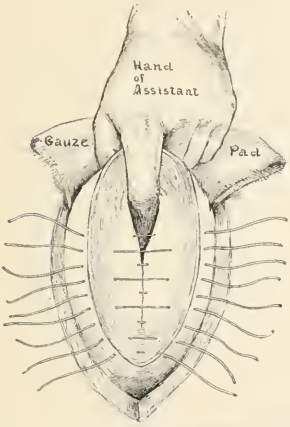
The proposition of Fritsch (1897) to open the uterus by a *transverse incision* over the fundus, in order to cut parallel to the course of the ovarian blood-vessels, and thus to avoid hemorrhage, has had many indorsers, but the method has no special advantage over the classic longitudinal incision.

Rupture of Membranes and Delivery of Fetus.—As soon as the incision is completed the left hand of the operator is introduced and, without rupturing the membranes if possible, the head is sought. The time has now come for the rupture of the membranes and the seizure of the head or feet, after which the delivery should be completed as rapidly as possible. The hand in the uterus should not be withdrawn until the complete extraction of the child is assured, since the uterus contracts very quickly after the membranes have been opened. Extraction should be done very deliberately. The fetal head is sometimes firmly grasped by the lower uterine segment, and to liberate it a finger of one hand should be hooked into the mouth and the head flexed until the smallest diameters are opposed to the superior strait and lower uterine segment. With the other hand the operator makes traction upon the feet in the axis of the uterus. If the head does not follow, the second hand placed astride the neck makes pressure upon the shoulders, and at the same time endeavors to maintain the head in flexion. (See Smellie-Veit method, page 978.) An extreme condition of incarceration

of the head in the superior strait should, of course, be recognized and corrected before the operation. After the child is extracted it is handed to an assistant to be wrapped in warm sterilized gauze, while the cord is clamped in two places, between which it is divided, a ligature being applied to the stump subsequently.

Placental Delivery.—To detach the placenta it should be grasped and squeezed like a sponge, whereupon it gradually comes away. Under gentle traction the membranes also peel off. In some cases the placenta lies loose in the uterus after the fetus is taken out. Care is necessary at this stage to keep the fluids from entering the general abdominal cavity. Many operators raise the uterus entirely out of the abdominal cavity and hold it in position for suturing by slipping a hot sterilized towel under it.

Uterine Sutures.—Sutures should be applied in three planes. Those of the deepest row should be about one-half inch (1.27 cm.) apart, they should be introduced into the external aspect of the uterus about one-fifth of an inch (0.53 cm.) from the margin of the incision and should emerge at the level of the space be-



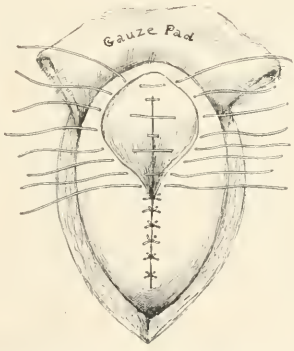


FIG. 1238.—SUTURE OF THE UTERINE WALL EXTENDING TO BUT NOT THROUGH THE DECIDUA.

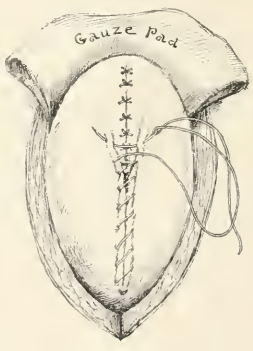


FIG. 1239.—SUTURE OF THE PERITONEUM IN CÆSAREAN SECTION.

tween the mucous and muscular layers (Fig. 1238). They are then carried across the wound to the same stratum of the opposite cut edge and outward through the uterine wall. The second plane consists of half-deep sutures, inserted between the deep sutures for closer approximation. Finally, the superficial sutures of fine silk unite accurately the peritoneal coat of the uterus (Fig. 1239). It must be borne in mind, however, that the first or deep layer is capable of something more than mere coaptation and constitutes a distinct form of hemostasis. If the usual measures for checking hemorrhage have been inadequate, the deep sutures may be inserted and tied at once. The presence of a slight anemic layer about the tightened suture shows us that the purpose of the latter is served; to go further would be to cut off some of the necessary blood-supply and favor septic infection. There is no need of putting any antiseptic material in the uterine cavity, nor does it need any other drainage than what takes place naturally through the os, provided the latter has been previously dilated.

Ligation of the Fallopian Tubes.—With the consent of the patient, the next step in the operation is the ligation and division of the Fallopian tubes.

Omental Adhesions.—The next step has reference to the prevention of omental adhesions. The omentum, which is normally situated in front of the uterus, is brought down and carried behind that organ in order to avoid the formation of utero-omental adhesions.

Abdominal Sutures.—The abdominal wound is closed with four planes of sutures: viz., continuous catgut suture for the peritoneum, interrupted catgut sutures for the muscles and fascia, and silkworm-gut for the skin.

Hemorrhage.—The operation of laparo-hysterotomy thus performed is not attended, as a rule, by much hemorrhage. If the bleeding is more profuse than usual, it may be controlled by tightening the elastic ligature or by the hands of an assistant grasping the broad ligaments and their contained blood-vessels. It is not well to constrict the ligature too persistently, or to tie more than one turn, for fear of provoking a reactionary hemorrhage when the constriction is withdrawn. It is better to control the hemorrhage by the measures customary in natural delivery; viz., friction, heat (application of hot cloths in this case), and the hypodermic injection of ergot. The latter drug may also be administered as a prophylactic at the moment the fetus is removed. In parenchymatous bleeding sponging with hot gauze is advisable. The suturing of the uterine incision has naturally a hemostatic effect.

Bladder. Bowels. Nursing.—The bladder should be emptied by catheter, at the end of the operation and as often thereafter as necessary. After each evacuation a thorough vulval douche should be administered (see page 881). A hypodermic of morphin is usually indicated during the first post-operative day, but at the expiration of twenty-four hours the child should be allowed to nurse and the drug should be discontinued. On the third post-operative day the bowels should be moved by enema.

After-treatment.—The abdominal sutures should be removed from the eighth to the twelfth day. An examination should be made after cicatrization is complete to determine whether or not adhesions have formed with resulting fixation of the uterus. As matters of interest and record it is valuable that the operator, after emptying the uterus, should note the position of the contraction ring and measure the true conjugate. The after-treatment is practically the same as after an extensive laparotomy for any condition.

XIII. ABDOMINAL HYSTERECTOMY.

This operation is performed through the abdominal incision, and consists either in the amputation of the uterus at the junction of the body and the cervix, and is then termed Incomplete Abdominal Hysterectomy, or, secondly, in the extirpation of the entire uterus, including the cervix, and is then known as Complete Abdominal Hysterectomy or Panhysterectomy.

Indications.—Hysterectomy proper has almost entirely superseded the Porro operation in instances where it is considered best to remove the uterus after Cæsarean section or rupture of the uterus. Its principal application is in cases in which in Cæsarean section sepsis of the uterus is suspected or known to be present; and in cancerous or myomatous growths of the uterus. In the exceptional cases of uterine atony following Cæsarean section abdominal hysterectomy may be the only means to control the resulting persistent hemorrhage.

Operation.—The operation is practically the same as in the non-pregnant state, and for its minute technique the student is referred to works on gynecology.

The *position of the patient* is the dorsal one with provision for raising the pelvis into the Trendlenburg posture when required. The *assistants* are an anesthetizer, two assistants, and a general nurse. The instruments required are, scalpel, blunt-pointed scissors, 6 artery clamps, 2 abdominal retractors, heavy hysterectomy traction forceps, 4 long-bladed broad ligament clamps, dressing forceps, right and left pedicle needles, needle-holder, 6 full-curved needles, 3 straight needles, No. 12 braided silk or No. 2 or 3 chromic catgut, No. 1 and 2 plain catgut, silkworm-gut. Because of the laxness of the abdominal walls, pelvic floor, and uterine ligaments, and the prominence of the uterine vessels, the operation is more readily performed in the puerperal than in the non-puerperal state. By reason of this laxness, the entire uterus and upper portion of the cervix can by traction be safely brought through the abdominal incision and

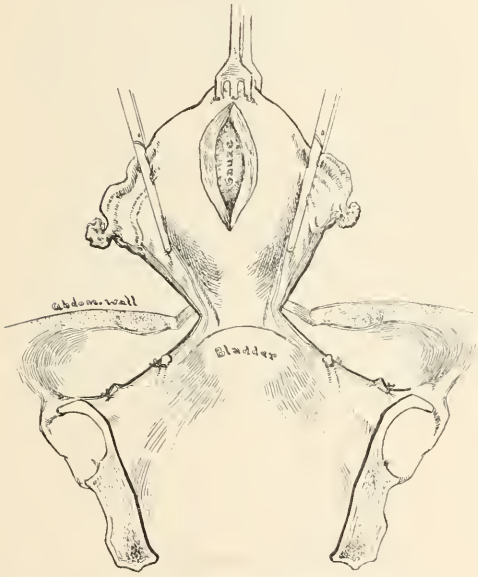


FIG. 1240.—INCOMPLETE ABDOMINAL HYSTERECTOMY. Shows the uterus drawn through the abdominal incision with the broad ligament clamps applied; ovarian vessels and round ligaments ligated separately, and broad ligaments divided.

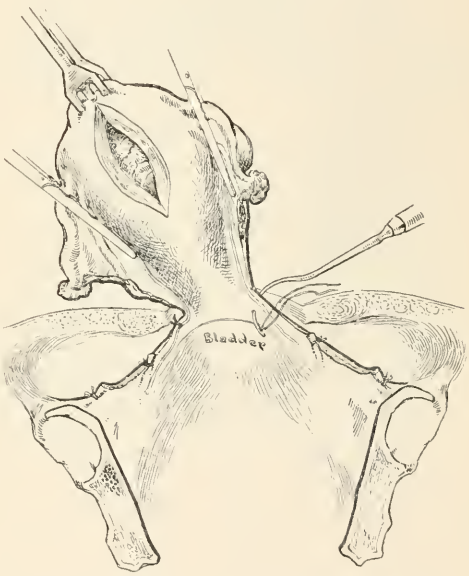


FIG. 1241.—INCOMPLETE ABDOMINAL HYSTERECTOMY. Shows the uterus drawn to one side and the opposite uterine vessels being ligated.

the clamps and ligatures applied upon the surface of the abdomen instead of in the pelvic cavity. Except in septic and cancerous conditions the incomplete operation will usually suffice, and is the one more quickly and safely performed.

Incomplete Hysterectomy.—Figs. 1240 to 1245 show the steps in incomplete hysterectomy, and it will be noted from the illustrations that the entire uterus is delivered through the incision. Also that the broad ligaments are clamped, and the ovarian and uterine vessels and round ligaments ligated, the broad ligament divided, the bladder stripped down and the uterus amputated at the level of the utero-cervical junction, upon the surface of the abdomen. The uniting of the stumps of the ovarian and uterine vessels, and closing-in of the raw surfaces by uniting the anterior and posterior flaps of the peritoneum, of necessity is performed within the abdomen (Figs. 1244 and 1245).

Complete Hysterectomy.—Figs. 1246 to 1250 show the steps in complete hyster-

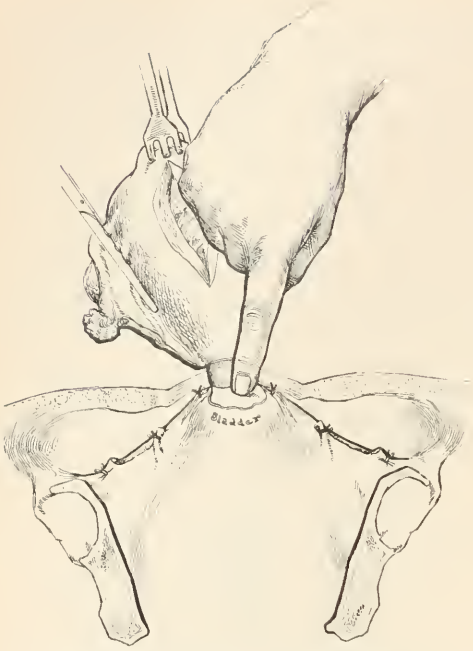


FIG. 1242.—INCOMPLETE ABDOMINAL HYSTERECTOMY. The broad ligaments are clamped close to the uterus. The uterine and ovarian vessels and round ligaments ligated and incised. The incision above the utero-vesical reflection of the peritoneum has been made and the bladder is being stripped down from the uterus with the finger.

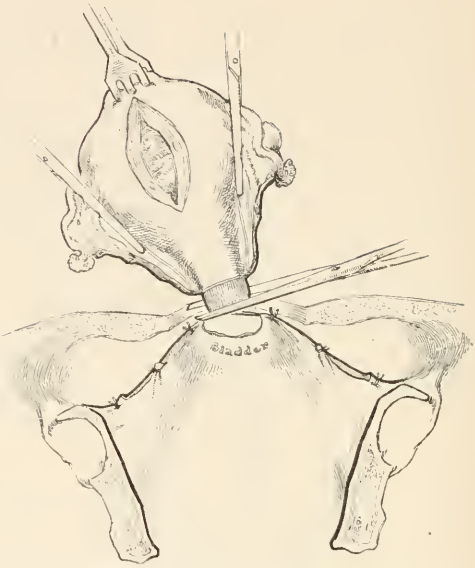


FIG. 1243.—INCOMPLETE ABDOMINAL HYSTERECTOMY. The bladder has been stripped down and the uterus is drawn upward and to one side and is being amputated at the utero-cervical junction.

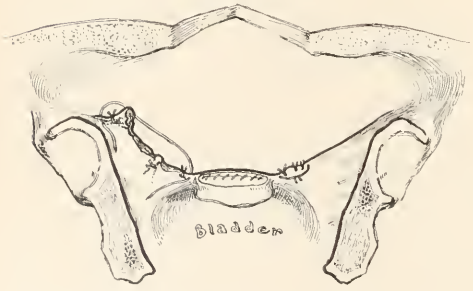


FIG. 1244.—INCOMPLETE ABDOMINAL HYSTERECTOMY. On the right side the stumps of the ovarian and uterine vessels are transfixed by a single ligature of No. 2 plain catgut. On the left side this ligature is drawn tight and tied, thus uniting the two stumps over the pedicle of the round ligament, and drawing the broad ligament tense to assist in the support of the vault of the vagina.

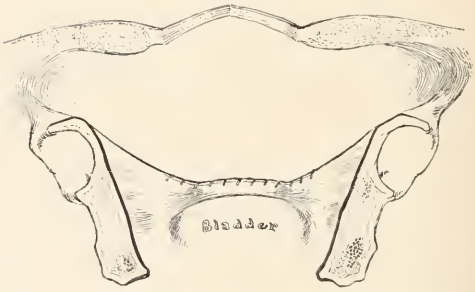


FIG. 1245.—INCOMPLETE ABDOMINAL HYSTERECTOMY. The stumps of the ovarian and uterine vessels and the round ligament are pushed under the peritoneum and the anterior and posterior flaps of the peritoneum are brought together by a continuous suture of No. 1 plain catgut.

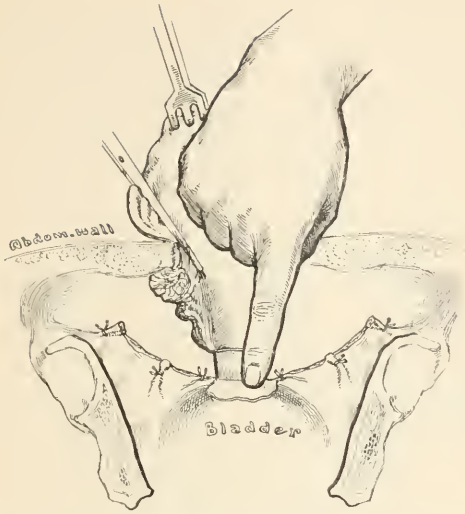


FIG. 1246.—TOTAL ABDOMINAL HYSTERECTOMY. The broad ligaments are clamped close to the uterus. The uterine and ovarian vessels and round ligaments ligated and incised. The incision above the utero-vesical reflection of the peritoneum has been made and the bladder is being stripped down from the uterus with the finger.

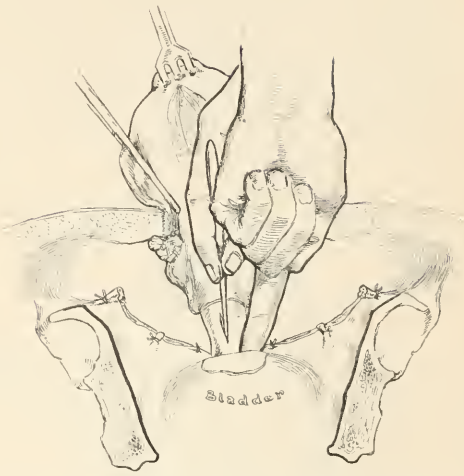


FIG. 1247.—TOTAL ABDOMINAL HYSTERECTOMY. The uterus is drawn upward with the traction forceps so as to put the vaginal junction on the stretch. The bladder is pushed forward with the index finger of one hand and with a scalpel in the other hand the anterior vaginal cul-de-sac is incised.

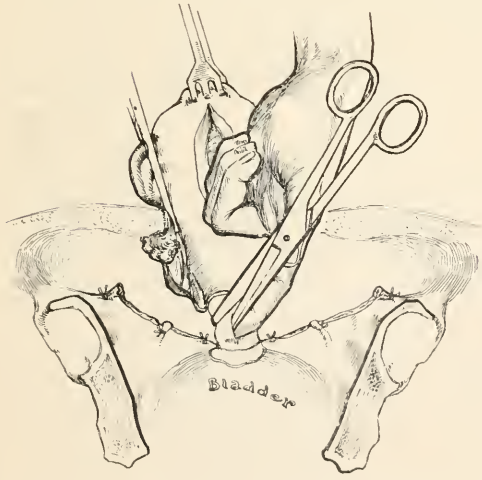


FIG. 1248.—TOTAL ABDOMINAL HYSTERECTOMY. The index finger of the left hand is passed through the incision into the vagina, and with a pair of scissors in the right hand the incision is carried entirely around the cervix, separating the latter from its vaginal attachments.

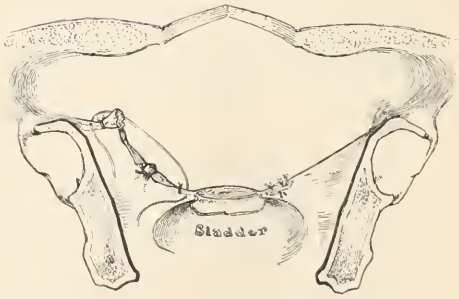


FIG. 1249.—TOTAL ABDOMINAL HYSTERECTOMY. The opening in the vagina is closed with No. 1 plain catgut, after all bleeding points have been ligated and the stumps of the ovarian and uterine vessels, and the anterior and posterior flaps of the peritoneum treated as in Fig. 1244.

ectomy, and I have purposely indicated in my drawings that the uterus is not drawn up as high through the abdominal incision as in the incomplete operation, though it could safely be drawn up much higher. The clamping of the broad ligament, the ligation of the ovarian and uterine vessels and round ligament, the dividing of the broad ligament, and the stripping down of the bladder are the same as in the incomplete operation (Figs. 1240, 1242). The vagina is then

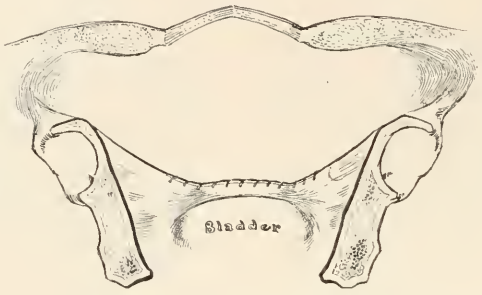


FIG. 1250.—TOTAL ABDOMINAL HYSTERECTOMY. Shows the anterior and posterior flaps of the peritoneum brought together as in Fig. 1245.

opened into as in Fig. 1247, and the incision carried around the cervix, separating the latter from its vaginal attachments as in Fig. 1247. The opening in the vagina is now closed by a continuous suture of No. 1 plain catgut, and the stumps of the ovarian and uterine vessels united (Fig. 1249). The anterior and posterior flaps of peritoneum are now made to cover the raw surfaces by a continuous suture of plain catgut (Fig. 1250).

XIV. PORRO-CÆSAREAN SECTION.

This operation is essentially a supravaginal amputation of the uterus, and under the name of Porro operation or Porro-Cæsarean section it has long been domiciled in Italy.

Indications.—The original indication for the Porro amputation was the prevention of sepsis, when the uterine cavity gave evidences of infection, and to escape the dangers of hemorrhage and leakage from the uterine incision of the ordinary Cæsarean section.

An additional indication was the prevention of further pregnancies in those illegitimately pregnant in the destitute, and in cases of tubercular and cardiac disease.

This last indication is to-day really secured in Cæsarean section by excising the tubes, removing the ovaries, or by an incomplete or total hysterectomy.

At the present day the Porro operation is rarely performed, because it is not in keeping with advanced surgical principles, because of the prolonged sloughing and healing of the extra-peritoneal stump, and the inverted scar which results in the anterior abdominal wall.

I am describing and illustrating it here because I believe it is still a life-saving measure in cases of serious uterine rupture, and labor obstructed by a large fibroid tumor in the hands of those who question their ability to perform the undoubtedly more correct surgical procedure of modern hysterectomy; and also when haste is of vital importance, as in rupture of the uterus, when the condi-

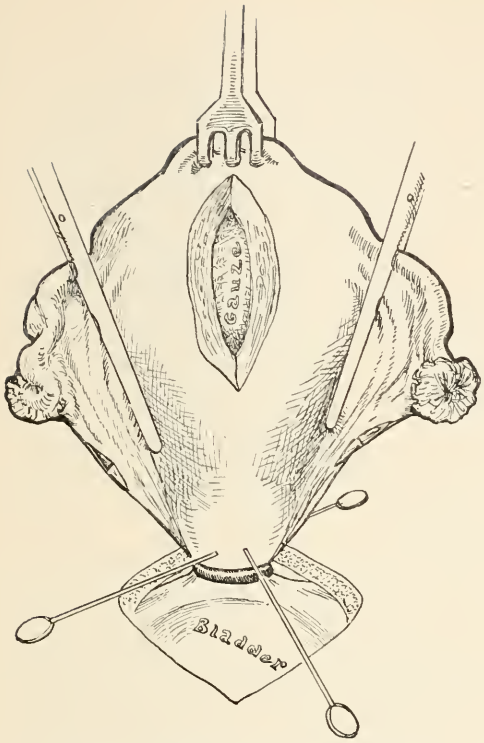


FIG. 1251.—PORRO-CÆSAREAN SECTION. Clamps are applied to the broad ligaments and the latter ligated, and cut through. Elastic ligature is applied and tied tightly above the cervix. Two transfixion pins are passed above the ligature.

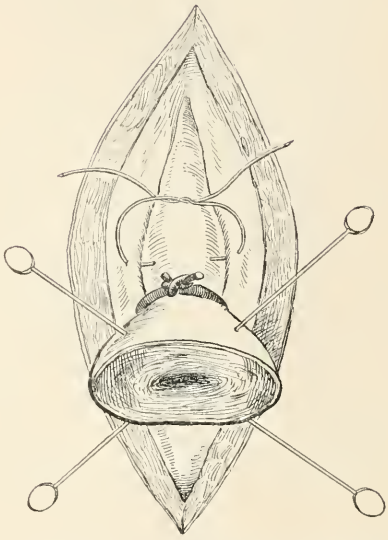


FIG. 1252.—PORRO-CÆSAREAN SECTION. The uterus is amputated a short distance above the transfixion pins.

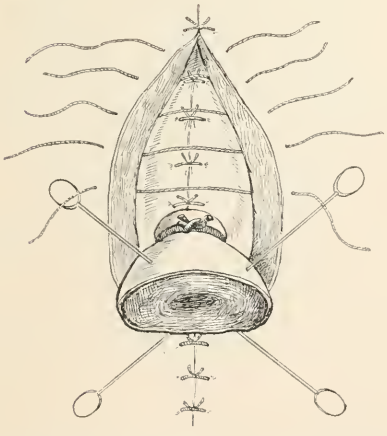


FIG. 1253.—PORRO-CÆSAREAN SECTION. Shows the peritoneum closed with plain catgut and the stitches for the abdominal wall tied below and in place above.

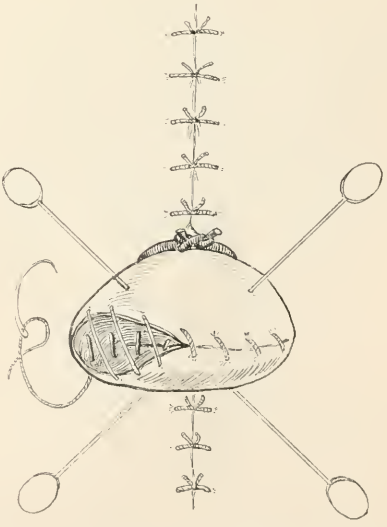


FIG. 1254.—PORRO-CÆSAREAN SECTION. Shows the abdominal wall closed, and the stump of the uterus being closed with a continuous suture.

tion of the woman is such that the shock of operation must be reduced to a minimum.

Operation.—The preparation and position of the patient are the same as for Cæsarean section proper.

Instruments.—Knife, stout straight scissors, six artery clamps, No. 2 plain catgut, 3 medium curved needles threaded with No. 2 catgut, six 2½-inch straight needles threaded with silkworm-gut, needle-holder, a stout rubber ligature and two transfixing pins for the stump (Fig. 1252), adhesive plaster, dressings.

Step One.—The abdominal incision is made as in Cæsarean section, hemorrhage is controlled, the uterus is turned out of the abdomen, and the abdominal cavity protected from contamination as in cases of Cæsarean section where a septic process in the uterus is suspected. The uterine incision is now made as in Cæsarean section and the child delivered. The cord and placenta are best left in the uterus.

Step Two.—The uterus is held well up in the abdominal incision by heavy forceps grasping the fundus (Fig. 1251) and a stout rubber ligature is firmly knotted about the junction of the uterus with the cervix, care being taken not to include the bladder, ureters or intestine (Fig. 1251).

Step Three.—The infundibulo-pelvic ligaments are now ligated with No. 3 plain catgut near the pelvic brim, and cut through on the uterine side (Fig. 1251).

Step Four.—Transfixion pins are passed through the stump at right angles just above the rubber ligature and the uterus amputated a short distance above (Fig. 1252). The transfixion pins rest upon the abdominal wall and prevent recession of the stump, and care must be taken that they do not include the bladder or ureters.

Step Five.—The stump is steadied in the lower angle of the abdominal incision and through-and-through interrupted silkworm-gut sutures are introduced to close the abdomen, the lowest of which transfixes the stump (Fig. 1253).

Step Sixth.—The peritoneum is closed by a continuous suture of No. 2 plain catgut, the lower portion being stitched to the serous surface of the pedicle below the transfixion pins, and the abdomen closed in the usual manner (Fig. 1254).

Step Seven.—The peritoneum of the pedicle is drawn over the stump by a continuous suture of No. 2 plain catgut.

Step Eighth.—The stump is dressed with dry dressings. After about two weeks the stump with pins and rubber ligature sloughs away, leaving a concave wound which heals by granulation.

XV. VAGINAL CÆSAREAN SECTION.

Definition.—A deep incision of the anterior cervical wall extending beyond the internal os into the lower uterine segment, and the delivery of the fetus through this opening by the forceps or version.

To Accononci in 1896, and to Dührrsen in the same year, belong the credit for the introduction of vaginal Cæsarean section.

Indications.—Although more than one hundred cases are now on record this operation is still in its experimental stage, because we have yet to learn of the danger of extension of the incision into the lower uterine segment in the extrac-

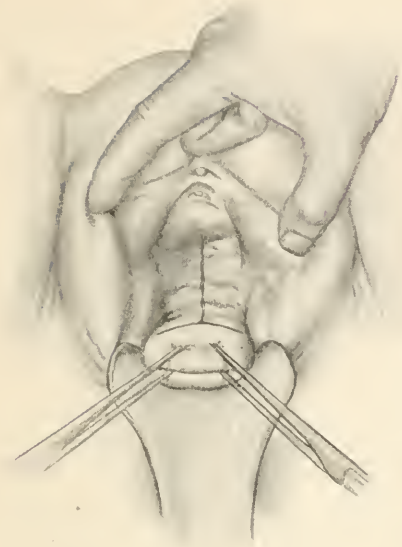


FIG. 1255.—VAGINAL CÆSAREAN SECTION. Shows initial incision. Transverse incision one and a half inches through mucous membrane at utero-vaginal junction and vertical incision extending from the middle point of the transverse incision longitudinally downward through mucous membrane of anterior vaginal wall to a point immediately below the urethra, thus making a "T" incision.

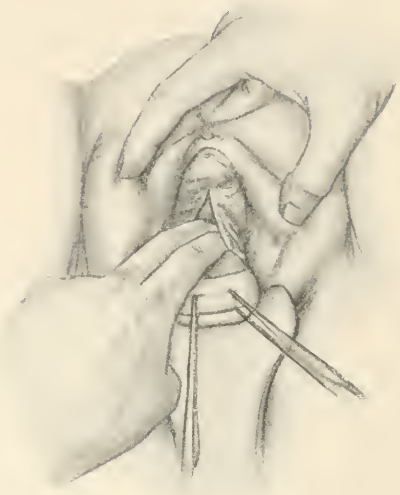


FIG. 1256.—VAGINAL CÆSAREAN SECTION. The flaps of the incision are turned back with the finger or blunt dissector and the bladder is strippd away from the cervix.

FIG, 1257.—VAGINAL CÆSAREAN SECTION. The anterior wall of cervix and lower uterine segment are bisected in the median line up to the reflection of the bladder, exposing the amniotic bag.

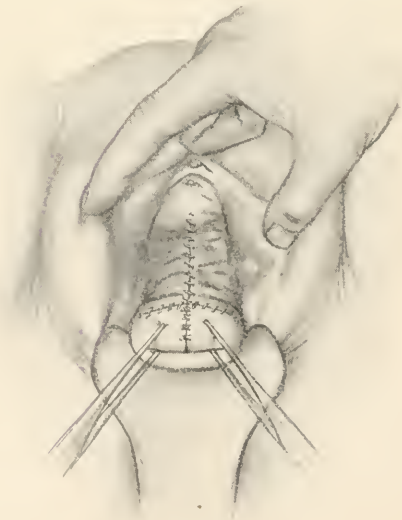


FIG. 1258.—VAGINAL CÆSAREAN SECTION. The incisions in the cervix and lower uterine segment are closed with catgut after emptying of the uterus, and the vaginal incisions are brought together over these with catgut.

tion of the fetus, and injury to the bladder resulting from the operation. It is probable, moreover, that the scar of the vaginal Cæsarean section in the thinned-out lower uterine segment in subsequent pregnancies will more readily rupture than that of the Cæsarean section by the abdominal route, which latter is near the fundus. In many of the cases reported and in most of those that have come under my personal observation, delivery by the abdominal route, or even by combined instrumental and manual dilatation of the cervix, would, it appears to me, have been preferable to the vaginal Cæsarean section.

The chief indication of the operation is in eclampsia, where rapid delivery is indicated and the condition of the cervix renders artificial rapid dilatation dangerous or impossible. Maternal cardiac disease and stenosis of the cervix, and possibly cancer of the cervix, are other indications. A markedly contracted pelvis with a true conjugate of 3.1 inches (8 cm.) is always a contraindication to the vaginal operation. Theoretically placenta prævia with a long undilated cervix would appear to be an indication.

Operation.—The patient is placed in the ordinary lithotomy *position*, and prepared as for a vaginal hysterectomy. The *assistants* required are, an anesthetizer, two assistants, and an obstetric nurse. The following *instruments* should be in readiness: one perineal and three long vaginal retractors; 4 bullet forceps; strong straight scissors; scalpel; artery clamps; needle-holder; 6 full-curved needles; No. 1 and 2 plain and No. 3 chromic catgut; vaginal dressings.

First Step.—The perineum is depressed with a broad speculum, and the cervix is grasped with two bullet forceps, placed one on each side of the median line about half an inch (1.25 cm.) apart. The cervix is now drawn downward and backward into the vulval outlet, and the mucous membrane at the utero-vaginal junction is incised laterally to the extent of an inch and a half (3.81 cm.). In order to secure a larger field to work in, some add a second incision at right angles to the above, and extending from the middle point of the transverse incision longitudinally downward through the mucous membrane of the anterior vaginal wall, thus making a "T" incision (Fig. 1255).

Second Step.—The bladder is now stripped away by the finger and blunt dissection up to the point of deflection of the peritoneum (Fig. 1256).

Third Step.— A long narrow-bladed speculum is now inserted, which elevates the peritoneum and exposes to view the length of the cervix and portion of the lower uterine segment (Fig. 1257).

Fourth Step.—With a pair of strong, straight, blunt-pointed scissors the cervix is now incised anteriorly in the median line through the internal os. Little bleeding usually results (Fig. 1257).

Fifth Step.—The incision in the uterus is now stretched either with the two index-fingers (Fig. 1257) or with one hand inserted into the vagina after the removal of all instruments. The fetal membranes now prolapse into the wound.

Sixth Step.—The fetus is now delivered by forceps or version, preferably the latter, the placenta and membranes manually extracted, and the uterine cavity washed out with normal saline solution and packed with iodoform gauze. It will sometimes be necessary to extend the uterine incision in order to extract the fetal head.

Seventh Step.—The perineal retractor is again placed in position, each side of the incised cervix again caught with bullet forceps, and the long narrow retractor placed to hold up the bladder and peritoneum anteriorly (Fig. 1257). The incision in the cervix is now closed with interrupted suture of No. 3 twenty-day chromic catgut, and the vaginal incisions with No. 2 plain catgut (Fig.

1258). The external portion of the cervical wound should be left in order to prevent undue contraction and improper uterine drainage.

It is technically permissible to divide the pelvic floor (Fig. 1100) and peritoneum (episiotomy), should the extraction of the fetus be otherwise impossible.

XVI. CÆSAREAN SECTION ON THE DEAD AND DYING.

Cæsarean section on the dead has fallen into disrepute at various times and in different localities for one of three reasons: First, statistics covering a limited experience have appeared to demonstrate that but few children were delivered alive in this manner, and that these few succumbed to secondary mortality; second, cataleptic women have been subjected to laparotomy under these circumstances; third, dead and dying women can be delivered by version or forceps without mutilation, and the children thus delivered show a high percentage of survivals. Nevertheless the spirit of the old *lex regia* which ordained that a dead woman in advanced pregnancy should be delivered by celiotomy is still in force, because it can be carried out with greater rapidity than version and extraction and forceps delivery. We know that the fetus may survive its dead mother for a certain period (see Coffin Birth, page 669), and that prompt intervention may save life. Naturally the child thus delivered will be profoundly asphyxiated from failure of the maternal circulation, but it may be resuscitated. When the mother has succumbed to a severe type of disease, the child is usually profoundly affected even before her death. The chances of survival are therefore far more unfavorable than in cases of sudden death of healthy mothers, under which circumstances children have survived *in utero* for as long a period as half an hour. But even when the mother is dying by inches of some severe general disease, the fetus still has a prospect of survival if celiotomy is performed before the entire failure of the placental circulation. It is possible also to extract the child rapidly per vaginam from its moribund mother. This operation is, of course, a most delicate one, and could be put in practice only under certain conditions, such as consent of the mother and her relatives in advance and after consultation with representative medical colleagues. The patient should be subjected to the most valid differential tests of death or the moribund state. In operating upon the dead or dying the same general technique obtains as in the ordinary conservative operation on the living. One cannot, however, always be particular in the choice of an instrument for making the incisions.

XVII. DELIVERY OF THE PLACENTA AND MEMBRANES.

1. Credé's Method. 2. Dublin Method. 3. Digital Extraction. 4. Instrumental Extraction. 5. Manual Extraction. 6. Digital Curettage. 7. Instrumental Curettage.

1. Credé's Method of Placental Expression.—According to Credé's original account of his method,* " the simplest and most natural method of artificially removing the placenta consists in inciting and invigorating the sluggish activity of uterine contraction. A single energetic contraction of the uterus brings the entire process to a rapid end. I have succeeded in innumerable cases, and without exception, in producing an artificial and powerful contraction of the uterus

* "Klinische Vorträge über Geburtshülfe," 1853, p. 599.

in from fifteen to thirty minutes after the birth of the child, and when the uterine action was ever so sluggish, by rubbing the fundus and corpus uteri through the

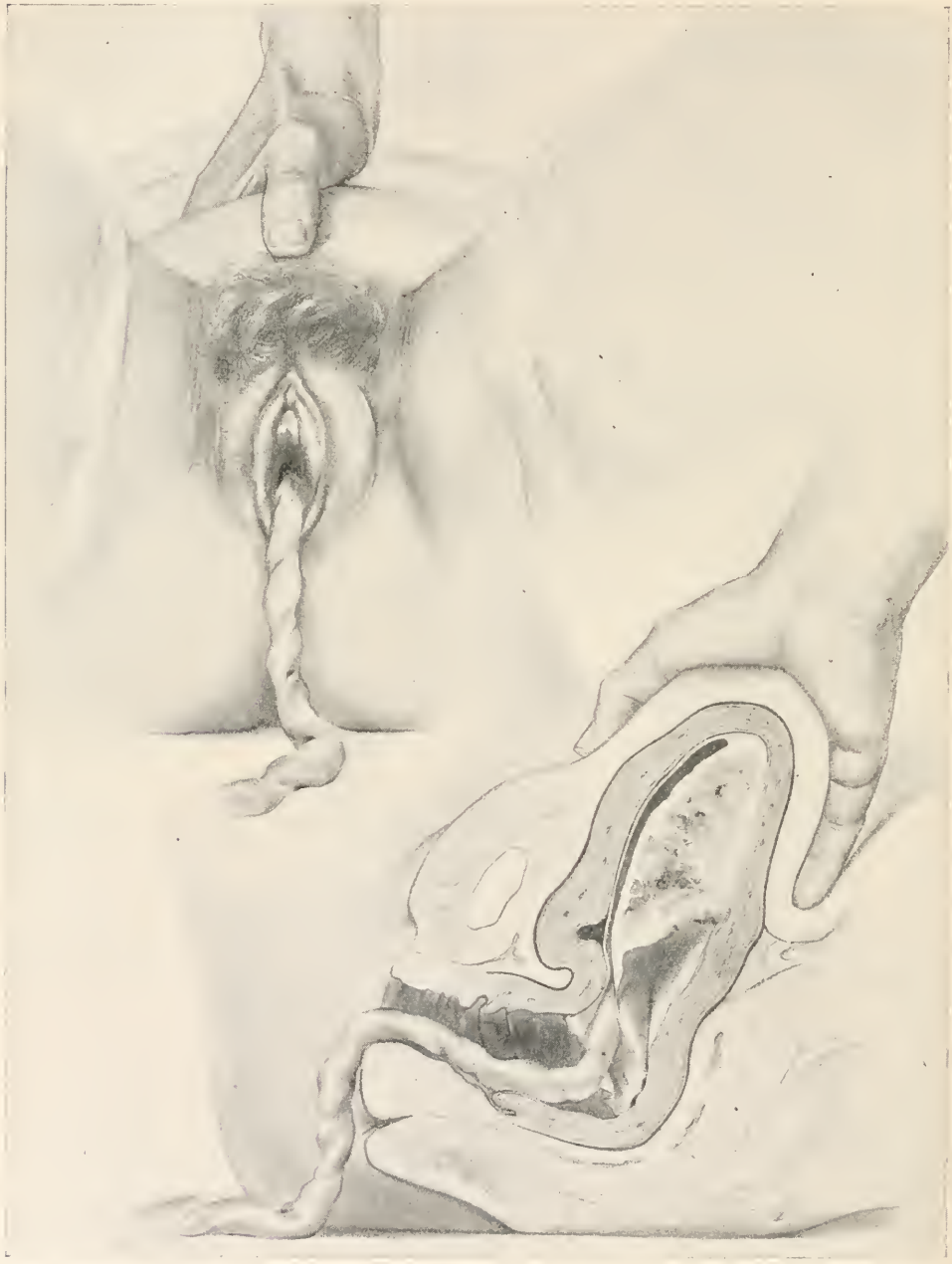


FIG. 1259.—CREDÉ'S METHOD OF PLACENTAL EXPRESSION.—(*The upper figure is from a photograph taken at the Emergency Hospital.*)

abdominal wall—gently at first but gradually with the expenditure of more force. As soon as the contraction has reached its maximum, I grasp the uterus entire in

such a way that the fundus lies in my palm while the fingers and thumb make gentle pressure upon the body of the organ. I invariably feel the placenta slipping from beneath my fingers, as a rule with such violence that it appears at the external genitals, or at least reaches the lowest part of the vagina. The patient experiences no discomfort from this manipulation beyond an increased sensation of pain during the uterine contractions, and it becomes unnecessary to introduce the hand into the birth canal, which has already become extremely sensitive as a

FIG. 1260.—DIGITAL EXTRACTION OF THE PLACENTA BY TRACTION WITH TWO FINGERS INTRODUCED INTO THE CERVIX, ASSISTED BY SUPRAPUBIC PRESSURE UPON THE FUNDUS.

result of the expulsion of the child. The uterus remains permanently contracted, hemorrhage is therefore less to be feared, and an inversion of the uterus can never occur as a result of a regular contraction, although this accident is always possible with the usually adopted method of removing the placenta." Shortly before his death Credé modified his method by allowing a delay of thirty minutes after expulsion of the child before beginning the use of his method.

In the absence of a positive indication, such as hemorrhage, artificial expul-

sion of the placenta should not be resorted to until post-partum uterine contractions have failed, after at least half an hour, to cause a spontaneous separation of the placenta and membranes. During this time the fundus of the uterus should be held in the hand and in atonic conditions gently rubbed, but never in the absence of a positive indication vigorously rubbed, to hasten separation of the placenta and membranes, nor should traction ever be made upon the cord for the same purpose. To carry out the method properly the bladder must be empty; the patient is placed in the dorsal position with the knees drawn up to relax the anterior abdominal wall (Fig. 1259); the fundus of the uterus is grasped with the whole hand, four fingers behind and the thumb in front; during a uterine contraction the fundus is compressed between the fingers and thumb, the fundus being at the same time directed as far backward toward the sacrum as circumstances will permit. The other free hand should be held in readiness at the vulva to prevent a too precipitate delivery of the placenta, as otherwise the membranes may be torn and portions retained.

FIG. 1261.—DIGITAL EXTRACTION OF A PIECE OF RETAINED MEMBRANES BY TWO FINGERS INTRODUCED INTO THE VAGINA, ASSISTED BY SUPRAPUBIC PRESSURE UPON THE FUNDUS.

Should expression at one post-partum uterine contraction fail, we must wait for the next contraction and repeat the process. In urgent cases both hands may be used to grasp the fundus, the eight fingers behind and the two thumbs in front. In this case particular care must be taken not to rupture a possible salpingitis or diseased ovary.

As soon as the placenta emerges from the vulval orifice it should be received into the hand (Fig. 635). If the membranes do not readily come away, it is best to rely upon uterine compression to expel them rather than to twist them into a cord by turning the placenta over and over gently, and so gradually separating them. Should a fragment be left hanging from the cervix or vagina, it may be carefully separated. Such bits as may be retained within the uterine cavity are best left to be discharged in the lochia if there is no hemorrhage. After the expulsion of the placenta and membranes, they must be carefully examined in order to see that they are complete (Fig. 637).

2. Dublin Method.—The so-called Dublin method of extracting the placenta is none other than the procedure which goes by Credé's name. It is true that the delivery of the placenta by external manipulation—as opposed to traction on the cord—was independently originated by the distinguished Strasbourg professor, and was popularized throughout the world through his personal advocacy; but it is none the less true that this method of extraction has been carried out in Dublin, almost from time immemorial. Hence a section on the so-called "Dublin method" should possess chiefly a historical interest. This question of priority was first agitated by M'Clintock and Barnes in 1876.*

* "The Dublin Method of Effecting the Delivery of the Placenta." By Henry Gellett, M.D., etc. Dublin, 1900.

3. **Digital Extraction.**—In most instances of retention the placenta lies loose in the uterine cavity or is only slightly attached to the uterus. In such cases, although Credé's method of expression fails, something less radical than the introduction of the whole hand into the uterus is called for to deliver the placenta. The author is accustomed to resort to what may be termed digital extraction in these cases. After proper preparation of the external genitals and vagina, the first and second fingers of either hand are introduced into the vagina, and the other hand on the fundus prolapses the uterus upon and over the two vaginal fingers. The placenta is now seized between the fingers, and by combined expression and traction the placenta and membranes are slowly delivered (Figs. 1260, 1261). Anesthesia is rarely necessary.

4. **Instrumental Extraction.**—Removal of the placenta and membranes by

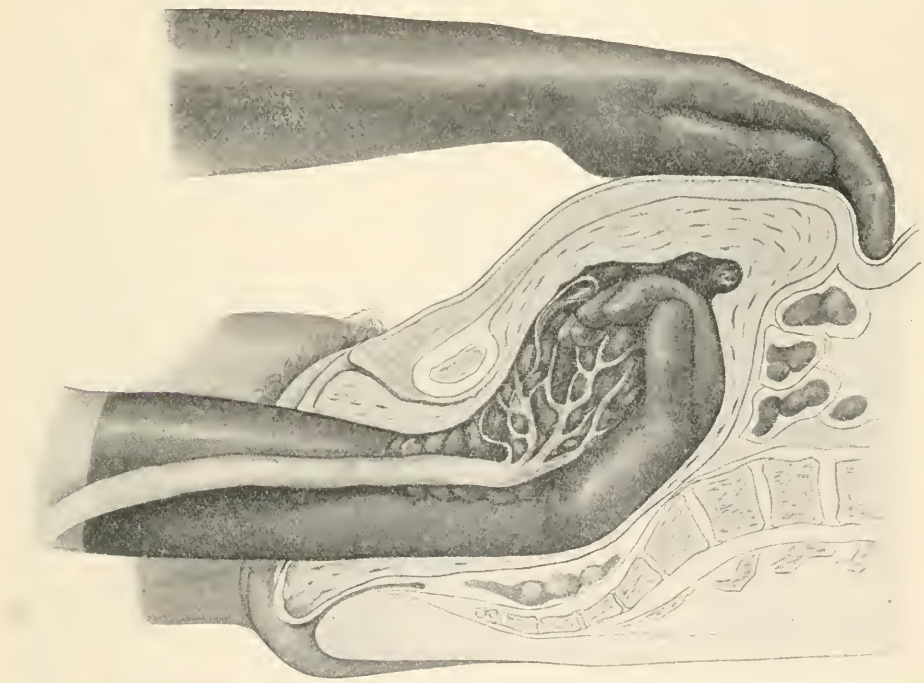


FIG. 1262.—MANUAL EXTRACTION OF THE PLACENTA BY THE INTRODUCTION OF THE WHOLE HAND INTO THE UTERUS, ASSISTED BY SUPRAPUBIC PRESSURE UPON THE FUNDUS.

means of the placental forceps possesses no advantages over digital or instrumental curettage, and I have long since abandoned this method.

5. **Manual Extraction.**—As a rule, ether or chloroform should be used. The patient is placed in the lithotomy position, the external genitals are thoroughly cleaned, and the vulva is separated to its widest extent with one hand. The other hand in the shape of a cone (Fig. 1114) is then carefully passed into the vagina. The hand separating the vulva is now transferred to the fundus, which it firmly grasps (Fig. 1262). Constrictions, if any exist, should be overcome by gradual dilatation with the cone-shaped hand. Should the placenta be found free in the uterine cavity, it is simply grasped and removed. If adhesions are present, however, the placenta is best separated by peeling it off by means of the fingers from above downward (Fig. 1262). In the presence of extensive and firm adhesions great care is necessary not to leave too much

placental tissue behind, and not to use the finger-nails too vigorously and thus lacerate the uterine walls too deeply. In firm adhesion, after the bulk of the placenta is removed, the placental site must be repeatedly gone over with the finger-tips in order to insure the complete removal of all placental tissue. (See digital curettage, page 1031.) In premature cases, and occasionally at term, the use of the smooth or even the sharp curette will be found necessary to clear the

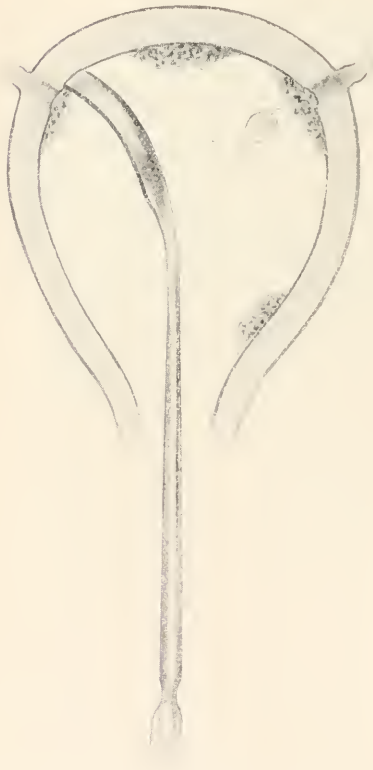


FIG. 1263.—INSTRUMENTAL CURETTAGE OF THE PUERPERAL UTERUS, WITH A CAUTIOUS UP STROKE OF THE CURETTE, AND A FIRMER DOWNWARD ONE.

FIG. 1264.—SHARP PUERPERAL CURETTE.

FIG. 1265.—BLUNT PUERPERAL CURETTE.

FIG. 1266.—THIMBLE CURETTE.

uterus of debris. The author has never found that the placental forceps possessed any advantages over the curette. Following the operation the uterine cavity should be freely irrigated with a 1 per cent. solution of creolin or lysol, decinormal salt solution, or 1 : 10,000 sublimate solution. Should atony and hemorrhage persist after complete emptying of the uterus, the bleeding is treated as in ordinary cases of post-partum hemorrhage.

6. Digital Curettage.—After proper cleansing of the hands, external genitals, and vagina, the os, if necessary, is either digitally or instrumentally dilated to allow the passage of one or two fingers. The first and second fingers of either hand are then passed into the vagina and the free hand upon the abdomen prolapses the fundus upon and over the vaginal fingers. The tips of the fingers are then made to pass over every portion of the endometrium, using them very much as we would the blunt curette to remove all placental or membranous tissue. The fingers can conveniently be used as a pair of forceps to withdraw loose pieces of debris through the os (Figs. 1261, 1054). Anesthesia can often be dispensed with.

7. Instrumental Curettage.—The patient is placed in the lithotomy position with the hips drawn well over the edge of the table. Anesthesia is necessary and ether is to be preferred, especially if the patient is somewhat exhausted from hemorrhage. The vulva, lower abdomen, and upper thighs are thoroughly scrubbed with green soap and water and afterward with sublimate or lysol solution. The vagina is then cleansed in the same way. A soft, five-inch jeweler's brush or a swab of cotton or gauze upon long dressing forceps should be used for the vagina. A perineal depressing speculum is now inserted and the cervix seized with one or two pairs of volsellum forceps. Much traction should not be made, the object being to steady the uterus. The os is then dilated with a steel dilator of the Goodell type. The uterine cavity is washed out with a sublimate solution (1 : 10,000) or a lysol solution, 2 per cent., a digital examination followed by another irrigation is made, and the uterus is curetted. The size and position of the uterus should be carefully estimated before the curette is introduced, and it may be necessary in rare cases to bend the handle of the instrument to suit the utero-vaginal axis. The curette should be carried carefully to the fundus, since perforations are usually caused by carelessness in this respect. The downward stroke may be moderately firm. The anterior, posterior, and lateral surfaces should be carefully scraped, especial care being taken to clear the cornua of debris, which frequently accumulates in these situations (Fig. 1263). The operator may know when he has reached the uterine wall by the characteristic grating sensation.

Choice of Instruments.—Much has been said as to whether the sharp or dull curette is to be used. It will often be best to use both, first the dull curette in order to remove the loosely attached decidua and placental tissue, and later the sharp instrument for the detachment of smaller adherent fragments and the thorough cleansing of the uterine walls. During and subsequent to the operation the uterine cavity is freely irrigated. It is not necessary to pack the uterus or vagina after the operation, unless this procedure is called for by severe hemorrhage or atony (see page 885).

(D) OPERATIONS FOR THE CORRECTION OF INJURIES.

I. CELIOTOMY IN RUPTURE OF THE UTERUS.

See Rupture of the Uterus, page 589.

II. CELIOTOMY FOR SEPSIS OF THE UTERUS.

See Fever, page 757.

III. REPAIR OF INJURIES TO CERVIX, VAGINA, RECTUM, PERINEUM, AND CLITORIS.

1. **Cervical Lacerations.**—The varieties of these lacerations have been described on page 593. Some writers have advised the immediate repair of all cervical lacerations, but it is now pretty generally conceded that it is neither necessary nor safe, since it increases the danger of sepsis and has no compensatory advantages, but rather interferes with drainage. Very deep lacerations, however, that cause severe hemorrhage and favor extension of infection to the parametrium should be promptly sutured.

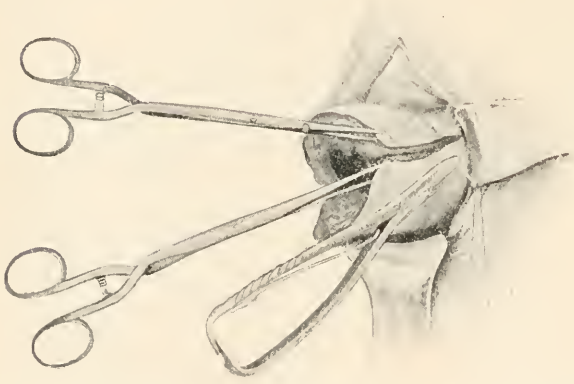


FIG. 1267.—REPAIR OF A DEEP LACERATION OF THE CERVIX.

The instruments needed are two pairs of volsellum forceps, and a needle-holder and large curved needles. In rare cases, as in cicatricial fixation of the cervix or in the case of a primipara with very small birth canal, a large speculum may be required. The patient being in the lithotomy position, the uterus is depressed by external pressure over the fundus. The anterior and posterior lips are then seized by the volsellum forceps, which assists if necessary in drawing down the cervix (Fig. 1267). The stitches should be about half an inch apart. The first should be above the angle of the laceration. In some cases a single stitch is sufficient.

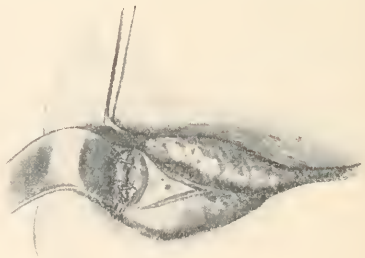


FIG. 1268.—REPAIRED LACERATED CERVIX. STITCHES IN PLACE.—(*From a photograph taken at the Emergency Hospital.*)

2. **Vaginal Lacerations.**—Lateral and anterior tears of the vagina should be repaired in accordance with the general principles laid down regarding injuries of the pelvic floor. Vesical and rectal fistulæ should be promptly repaired if the extent of the injury can be defined. In cases of sloughing, however, this cannot be done, and it will be necessary to wait for the secondary operation, which in the interest of the patient should be performed as soon as possible. It is, therefore, of the greatest importance to the patient that an exact diagnosis should be made. The presence of vaginal fistula may be confirmed by injecting

into the bladder warm milk which has been boiled, or some sterilized solution of one of the anilin dyes in harmless quantity. Flatus and feces escape into the vagina if the rectum has been penetrated; urine if the fistula communicates with the bladder. The immediate operation does not differ from the secondary operation except that there is, of course, no denudation.

3. Pelvic-floor Lacerations.—The term "perineal lacerations" as usually employed is anatomically incorrect, since it is made to include lacerations of the posterior vaginal wall, perineum, and rectum. Since, however, lacerations involving these structures frequently occur together, and since the operations for their repair are frequently combined, it is convenient for clinical purposes to consider them together under three degrees. (See Part V, page 595.) *First Degree:* Superficial perineal or perineo-vaginal lacerations. These consist usually of a tear of skin and mucous membrane, and may be regarded as extensions of the tear of the fourchette which so often occurs in first labors (Figs. 1269, 1270). *Second Degree:* Vaginal or vagino-perineal lacerations which extend more deeply but do not involve the sphincter ani. These may or may not involve the skin surface of the perineum. The former is most frequently the case in operative deliveries. Very commonly the internal laceration takes the form of a transverse tear within the vaginal orifice with prolongations which extend up one or both sides of the posterior column (Fig. 1270). This variety of laceration may not be suspected unless the vagina is examined at the close of labor (Fig. 1269). *Third Degree:* Vagino-perineo-rectal lacerations in which the sphincter ani is involved. Tears of this degree involving the sphincter ani and rectum extend upward for a variable distance, and, like tears of the second degree, are prone to follow one or both sides of the posterior vaginal wall. Very rarely the column is divided in the median line. Central perforations of the perineum or pelvic floor may occur. (See Part V, page 597.) In central perforations the fold of skin at the perineum may be torn away by the shoulder during delivery, the resulting laceration looking like one of the second degree.

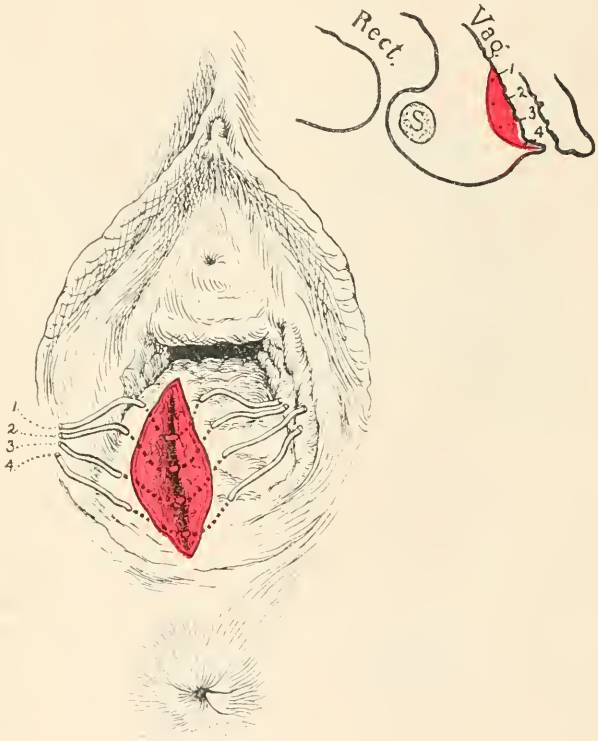


FIG. 1269.—FIRST DEGREE OR SUPERFICIAL PERINEO-VAGINAL LACERATION OF THE PELVIC FLOOR. RIGHT VAGINAL SULCUS ONLY INVOLVED. STITCHES FOR REPAIR IN PLACE. Note the numerical order of passing the stitches.

Reasons for Immediate Operation.—Superficial tears of the fourchette which

usually occur in first labors do not require attention. Larger superficial tears—*e. g.*, those which have a base of from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch—may become infected, or in rare cases may lead to the formation of sensitive scar tissue and should be sutured. All other tears should be immediately sutured, since otherwise not only is the danger of sepsis increased, but the patient may be a life-long invalid as the result of injury to the pelvic floor. If the patient's condition is such that the operation is deemed unsafe, *e. g.*, after severe hemorrhage, or if the laceration is severe, and the operator distrusts his ability and needs skilled assistance, it may be postponed for from twelve to twenty-four hours, careful asepsis being maintained in the mean time.

General Principles.—The operator should use great care as to asepsis, but should not employ chemical antiseptics. He should clear the field of operation from blood by irrigating with saline solution and sponging with sterilized gauze, and bring the parts as nearly as possible into their normal relations by means of tenacula in order to appreciate the extent and character of the injury. He should aim to secure exact approximation of denuded surfaces in their normal relative positions. He should snip away with the scissors necrosed tags or bruised bits of tissue, and leave no pockets for the collection of stagnant secretions. This is to be avoided by not allowing the needle to appear in the wound, or, when the Emmet suture is used, by entering the point again in the deepest part of the wound.

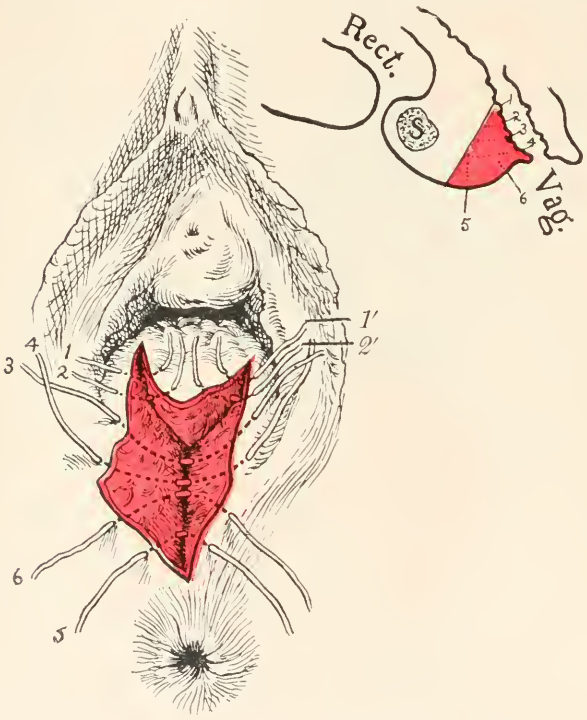


FIG. 1270.—FIRST DEGREE OR SUPERFICIAL PERINEOVAGINAL LACERATION OF THE PELVIC FLOOR. BOTH VAGINAL SULCI INVOLVED. SHOWS METHOD OF PASSING THE STITCHES FOR REPAIR. Note the numerical order of passing the sutures.

Operation.—In the slighter degrees of laceration anesthesia is not usually necessary, the tissues being benumbed by pressure, and the patient still perhaps partially under the influence of an anesthetic. In the severer forms in which careful suturing is required, anesthesia will usually be needed, and if such a rupture occurs it is best, if an anesthetic has been administered during the expulsion of the head, to continue its use until the laceration has been repaired, thus obviating the necessity of re-anesthetizing the patient, and lessening the amount of the anesthetic to be administered. (Compare Management of Labor, Part IV.) The patient is placed in the lithotomy position with the hips drawn well over the edge of the bed or table, and the upper part of the vagina is temporarily packed with sterilized gauze to check the flow of blood and enable the operator to see what he is doing. The instruments needed are: needle-holder; small and

medium-sized curved needles; a pair of scissors; a speculum or retractor for the anterior vaginal wall (in tears of the third degree it is well to have two retractors, one for each side); tenacula; suture material.

A needle-holder is not absolutely necessary unless the laceration extends far up into the vagina. Retractors may be improvised from bent spoons. A single suture with the ends left long and held by an assistant takes the place of a tenaculum, and ordinary sewing-needles or darning-needles sterilized in a flame may be used in an emergency. Silk, silkworm-gut, catgut, or silver wire may be used. Catgut is preferable for the vagina, since it does not require removal. Silkworm-gut is preferred by many operators. It can be easily rendered aseptic by boiling for ten or fifteen minutes. It is especially serviceable when deep sutures embracing a large amount of tissue are to be passed.

First Degree.—The operation is very simple. The sutures are passed as in Figs. 1269, 1270. The labia being separated by the fingers of the left hand, the wound is closed from above downward by interrupted sutures, the needle being introduced close to the upper angle of the wound near its margin, not appearing in the wound but emerging at a corresponding point on the opposite side. Two sutures, with perhaps two or three additional sutures for the skin-surface, will usually be sufficient.

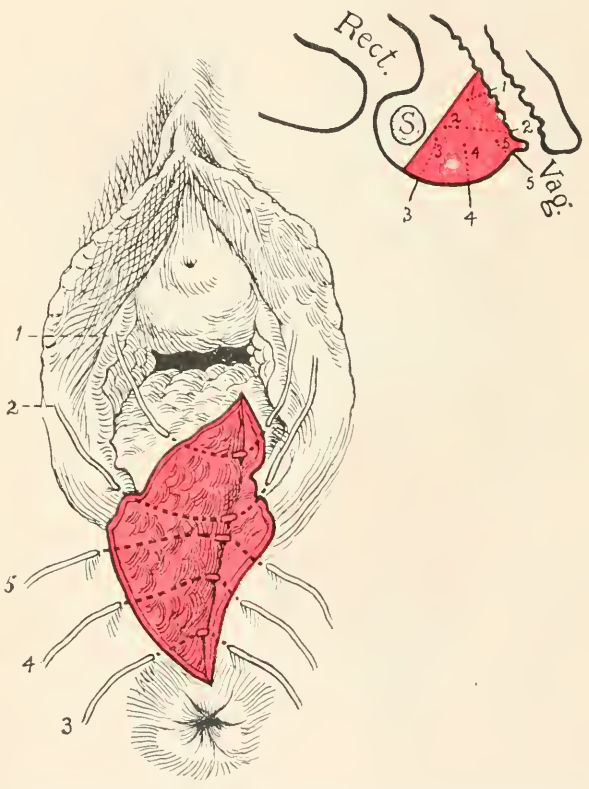


FIG. 1271.—SECOND DEGREE OR DEEP VAGINO-PERINEAL LACERATION OF THE PELVIC FLOOR, NOT INCLUDING THE SPHINCTER ANI. THE LACERATION IN THIS CASE INVOLVES THE LEFT VAGINAL SULCUS. STITCHES FOR REPAIR IN PLACE. Note the numerical order of passing the sutures.

Second Degree.—The anterior vaginal wall is drawn up by a retractor and the parts are temporarily restored to their respective positions by tenacula. The vaginal lacerations are sutured from above downward (Fig. 1271). If there are two, one on each side of the posterior column, they should, of course, both be repaired, but care should be taken that the posterior column, often bruised and detached from below upward, is left in its normal position (Fig. 1271). In order that the lower portions of the wounded surface may be lifted up and brought into contact in the same relative positions which they previously occupied, the Emmet suture should be used. In this method of suturing the needle is not passed directly across the wound but downward until it appears in the floor of the laceration, then re-entered and carried upward again until it appears at a point on the

opposite side of the laceration corresponding to that at which it first entered. The first suture closes the upper end of the laceration. "The sutures below this must then be passed with the two distinct objects in view: of grasping the torn muscular tissue on the lateral wall by deep suturing and of exercising a definite lift, each suture helping to lift up the pelvic floor." They should be about one-half inch apart, and care should be taken not to pass it into the rectum. After the sulci have been closed in the manner above described, the remaining denuded area will be found surprisingly small. It may be closed by a single purse-string suture, which should also be made to transfix and hold in its proper place the end of the posterior column. The suture enters the skin surface of the perineum and emerges at a corresponding point on the opposite side. In place of this purse-string suture two or three interrupted sutures may be used. A few superficial sutures should be inserted wherever necessary to secure accurate coaptation.

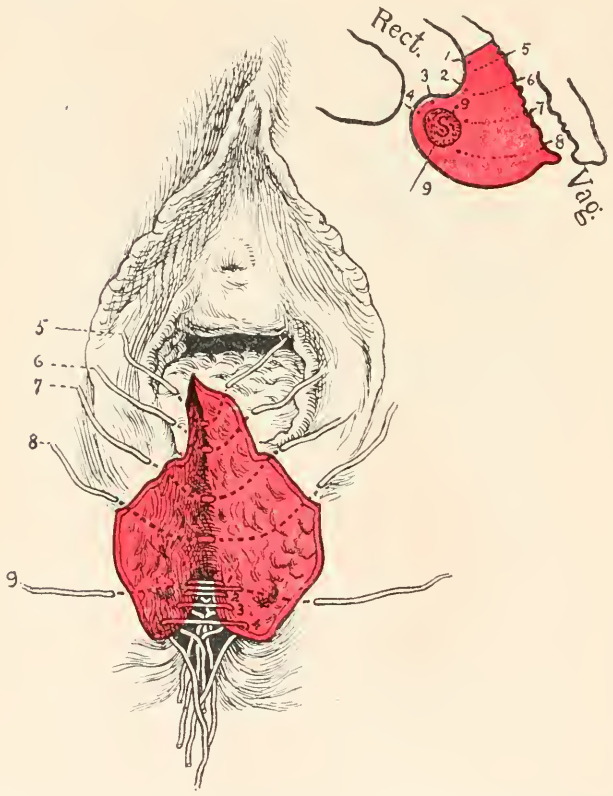


FIG. 1272.—THIRD DEGREE OR VAGINO-PERINEO-RECTAL LACERATION OF THE PELVIC FLOOR, IN WHICH THE SPHINCTER ANI IS INVOLVED. SHOWS METHOD OF PASSING THE SUTURES. Note the numerical order of the stitches, and that 9 transfixes the sphincter muscle on both sides.

Third Degree. — The results of this variety of laceration are so deplorable that an immediate operation is of special importance. If, however, the operator distrusts his own skill or is without suitable instruments and suture material, it is better to delay the operation for from twelve to twenty-four hours until he can obtain skilled assistance. The patient being in the lithotomy position and the field of operation being exposed by retractors, one on each side, the rectal tear is first closed from above downward by interrupted sutures of silk and fine catgut about one-sixth of an inch apart (Fig. 1272). These are passed from one-fifth to one-fourth of an inch from the edge of the mucous membrane, taking up just enough of the tissues of the recto-vaginal septum to secure a good hold. If catgut is used, the sutures are tied in the rectum and the ends cut short. If silkworm-gut or other non-absorbable material is used, the sutures are tied in the rectum and the ends left long so as to hang out of the anus. The ends of the sphincter should be united by two or three extra fine catgut sutures. If the sphincter has been badly torn

and the ends have retracted, they should be drawn out with a tenaculum before suturing and the extra sutures in the sphincters should be reinforced by one or two sutures of silk or silkworm-gut, which should be passed through the external skin at a greater distance from the torn ends of the sphincter and should pass above the angle of the tear and emerge at a corresponding position on the opposite side. The laceration is thus converted into one of the second degree, the treatment of which has been already described (Fig. 1271). If the vaginal laceration extends far up into the vagina, its upper portion may first be sutured, next the rectal rent and sphincter repaired, and the operation completed as above described (Figs. 1272, 1273). In the rare cases of central perforation of the perineum already described, the anterior portion of the perineum should be divided, since it is of no service and prevents proper inspection of the deeper part of the wound. The laceration is then treated as already described.

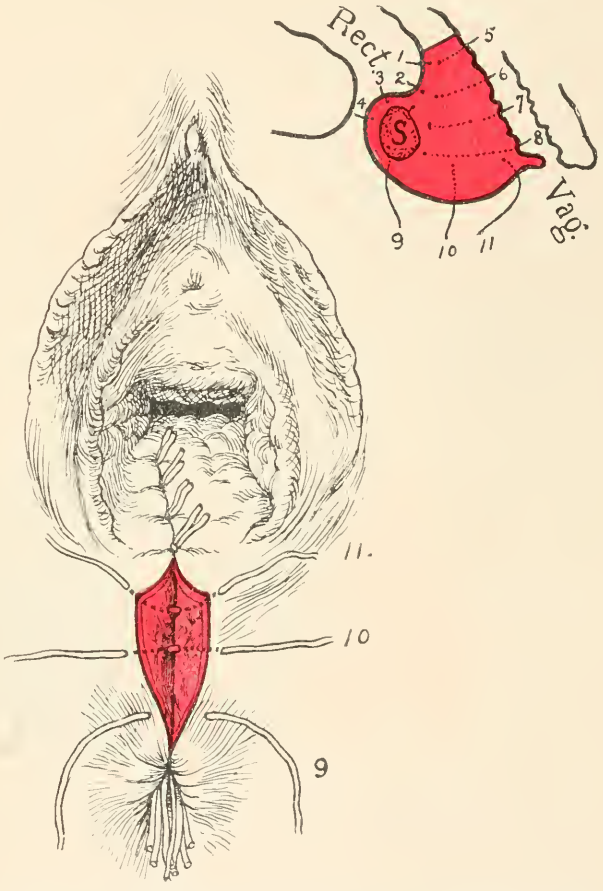


FIG. 1273.—THE RECTAL AND VAGINAL SUTURES OF FIG. 1274 ARE TIED, THE FORMER IN THE RECTUM, LEAVING ONLY THE TWO PERINEAL OR EXTERNAL SUTURES, 10 AND 11, AND THE SPHINCTER SUTURE 9 TO BE TIED.

After-treatment. —The knees should be loosely bound together (Fig. 919). The use of the catheter should be avoided if possible. Scrupulous cleanliness of the external genitals should be secured, and after urination and defecation the parts should be washed with a weak sublimate solution. If the lochia are normal, no douches are indicated. The bowels should be kept open after the second or third day. If an enema is necessary, it should be intrusted only to an experienced nurse. Since the tube has been passed into the sutured laceration, it should be pressed against the posterior margin of the anus. If a vaginal douche becomes necessary, the same care should be used, the syringe being pressed against the anterior vaginal wall. The sutures should be removed about the eighth or tenth day.

APPENDIX.

HISTORY RECORDS.

In Private Practice.—I am in the habit of urging upon my students the importance of starting some method of history-taking in order that they may subsequently profit by a study of their cases. Should the physician not take up some methodical system of recording his cases at the outset of his practice, he is not likely to do so later. Of course, it is not always pleasant to acknowledge one's errors upon paper, but one can learn as much or more from a subsequent study of such errors as from successes. I have at various times in the past used the ordinary history sheets and history books for this purpose, but experience has proved the card system to be more satisfactory, because simple, orderly, and self-

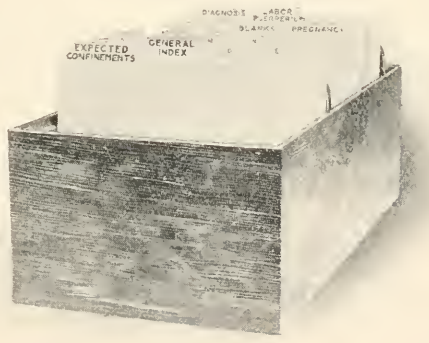


Fig. 1274.—Card Index Case for Obstetrical Histories

indexing. The cards I use are of standard size ($6 \times 6\frac{11}{16}$ inches). Such cards are elastic and portable and can readily be used at the bedside or operating room, for, when doubled, the history of the patient can easily be carried in the pocket or card-case. Any of the different methods of indexing the cards may be used. For obstetric cases I use three printed cards: The first, *pregnancy* (Figs. 1275 and 1276); the second, *labor* (Fig. 1277) *and puerperium* (Fig. 1278); and the third, a *diagnosis* card (Fig. 1279), which is practically a blank and is used for complications and where the first two cards prove insufficient to contain a given history. My index cards are made for me by the Globe-Wernicke Co., 380–382 Broadway, New York.

The observations to be noted under pregnancy (Figs. 1275 and 1276), labor (Fig. 1277), and the puerperium (Fig. 1278) have been carefully selected, and are the result of many years' experience in obstetric history-taking. Such card-history records, of course, need not be limited to obstetrics, for the same case with the blank "diagnosis" cards (Fig. 1279) may be applied to general medicine and surgery.

Method of using the History Cards.—As already stated, there are only three printed cards for each case, as labor and the puerperium are contained upon one

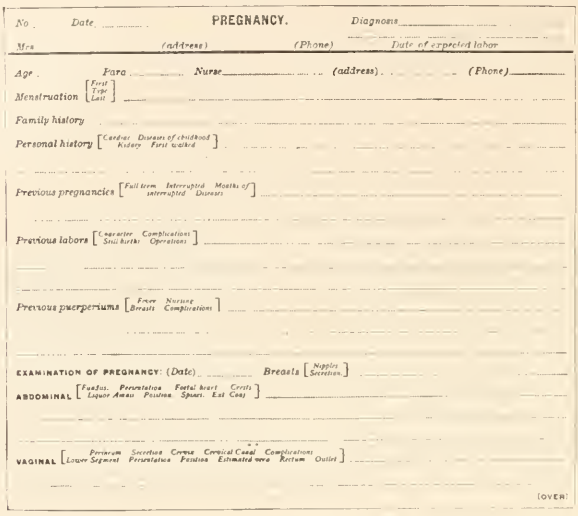

No. Date
PREGNANCY.
Diagnosis
Mrs (address) (Phone) Date of expected labor
Age Para Nurse (address) (Phone)
Menstruation [First Last]
Family history
Personal history [Cardiac History Diseases of childhood First worked]
Previous pregnancies [Full term Interrupted Interrupted Months of Diseases]
Previous labors [Character Still births Complications Operations]
Previous puerperiums [Fever Breasts Nursing Complications]
EXAMINATION OF PREGNANCY: (Date)
Breasts [Nipples Secretion]
ABDOMINAL [Fundus Lower Area Presentation Position Fetal heart Spines Cysts Est. Cap]
VAGINAL [Perineum Lower Segment Secretion Presentation Cervix Position Cervical Canal Effaced Complications Os Rectum Outlet]
(OVER)

Fig. 1275.—Pregnancy Index Card; this Side of Card is for a History of the Case and the Examination of Pregnancy; this Card also acts with Others Arranged Consecutively as an Index of the Dates of Expected Confinements.

card. For convenience in indexing and selecting, I use three colors—blue for pregnancy, salmon for labor and puerperium, and buff for the diagnosis or blank card. The pregnancy cards I keep by themselves, in the proximal end of the case,

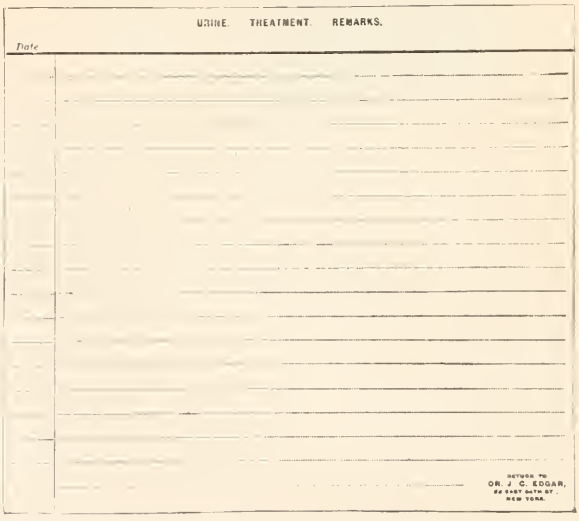
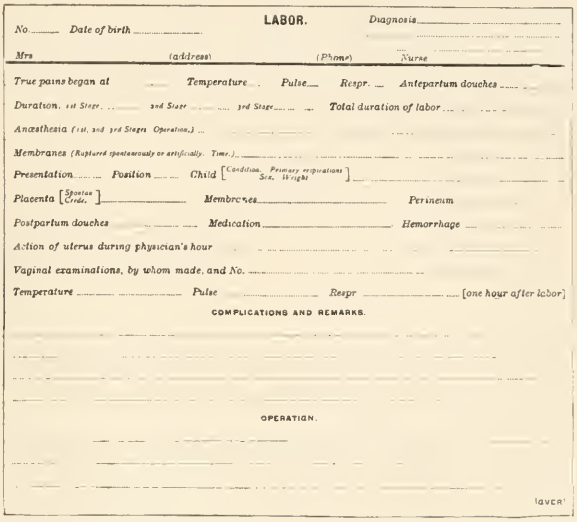


Fig. 1276.—Reverse of Pregnancy Card; upon this Side of the Card are Recorded the Results of the Various Urinary Examinations of Pregnancy, as well as Treatment or Remarks.

until finally indexed, and they constitute during this time an index of cases of *expected confinement*. Upon seeing a case of pregnancy in the office or at the

patient's home, the pregnancy card is made out and returned to its place in the box, and this becomes a record of a case of an expected confinement (Fig. 1274).



LABOR.

No. ____ Date of birth ____ Diagnosis ____

Mrs ____ (address) ____ (Phone) ____ Nurse ____

True pains began at ____ Temperature ____ Pulse ____ Respr. ____ Antepartum douches ____

Duration, 1st Stage ____ 2nd Stage ____ 3rd Stage ____ Total duration of labor ____

Anæsthesia (1st, 2nd and 3rd Stages Operation,) ____

Membranes (Ruptured spontaneously or artificially. Time.) ____

Presentation ____ Position ____ Child [Condition, Primary respirations, Sex, Weight] ____

Placenta [Spontaneous, Credé.] ____ Membranes ____ Perineum ____

Postpartum douches ____ Medication ____ Hemorrhage ____

Action of uterus during physician's hour ____

Vaginal examinations, by whom made, and No. ____

Temperature ____ Pulse ____ Respr ____ [one hour after labor]

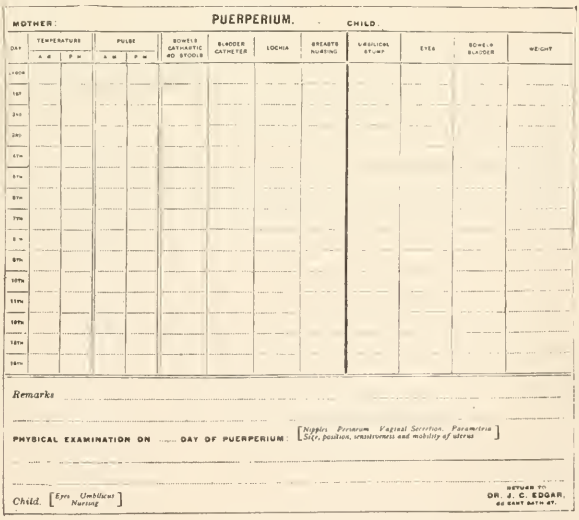
COMPLICATIONS AND REMARKS.

OPERATION.

[over]

FIG. 1277.—LABOR AND PUERPERIUM CARD; UPON THIS SIDE OF THE CARD IS RECORDED THE HISTORY OF LABOR; SHOULD MORE ROOM BE REQUIRED FOR HISTORY OF COMPLICATIONS OR OPERATIONS, A DIAGNOSIS BLANK CARD (FIG. 1279) IS USED IN ADDITION.

Upon the receipt of the first specimen of urine, the analysis, with date, is recorded upon the back of the card, as well as any subsequent treatment or re-



MOTHER: PUERPERIUM. CHILD.

DAY	TEMPERATURE A M	TEMPERATURE P M	PULSE A M	PULSE P M	BOWELS CATHARTIC OR STOOLS	BLADDER CATHETER	LOCHIA	BREASTS NURSING	UMBILICAL STUMP	EYES	BOWELS BLADDER	WEIGHT
LABOR												
1st												
2nd												
3rd												
4th												
5th												
6th												
7th												
8th												
9th												
10th												
11th												
12th												
13th												
14th												

Remarks ____

PHYSICAL EXAMINATION ON ____ DAY OF PUERPERIUM [Nipples, Perineum, Vaginal Secretion, Parametria, Size, position, evenness and mobility of uterus]

Child. [Eyes, Umbilicus, Nursing]

RETURN TO DR. J. C. EDGAR, 46 EAST 54TH ST.

FIG. 1278.—REVERSE OF FIG. 1277; RECORD OF PUERPERIUM AND EXAMINATION OF THE PATIENT AT THE END OF PUERPERIUM AND ATTENDANCE.

marks upon the case. Upon being called to a case of labor, one selects the proper pregnancy card and a blank labor card to take with him to the case.

During or after labor, the labor card is filled in and left at the case for the nurse to record the observations of the puerperium of both mother and child, the pregnancy card being returned to its place in the case.

Should the labor or puerperium prove complicated, requiring more space, the history is abstracted on the buff diagnosis card, and given a number referring to the detailed account of the case, written on the usual bedside history charts, which latter history sheets are filed in large letter-file boxes. The buff abstract card is then indexed alphabetically with the other cards.

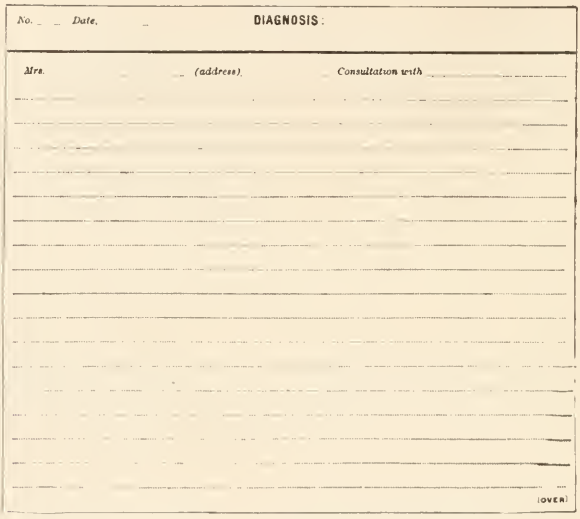


Fig. 1279.—Blank Card Ruled; Used as Extra Card in Pregnancy, Labor, or Puerperium, or as Index Card for General Non-obstetric Subjects.

At the completion of the puerperium, the labor and puerperium card is returned to the box. At the end of the year, or other convenient time, all cards belonging to a given case are fastened together with a brass clip and indexed among the alphabetical guides at the distal end of the box (Fig. 1274).

Institutional and Educational.—I append a serviceable, convenient, and more elaborate obstetric history chart for institutional and educational work, which is successfully used at the Manhattan Maternity and Dispensary, New York.

Manhattan Maternity and Dispensary,

327 East 60th Street,
NEW YORK CITY.

Diagnosis .....
.....
.....
.....

Confinement No.....
Outdoor App. No.....
Date of App.....19.....
Date of Labor .....19.....

GENERAL HISTORY.

Name.....Para..... Nationality.....Age.....

Address.....House.....Floor.....Married, Single, Widow.

Occupation.....(Husband's Occupation.....Wages per week.....No. in Family ....employed {Yes, No.}

Family History.....Tuberculosis, Syphilis.

Personal History of Rickets, Syphilis, Gonorrhœa, Leucorrhœa, Pelvic Trouble; Heart, Lung, and Kidney Disease (*Addenda*).

Last Menstruation, {*Sure or Doubtful,*} First Day of.....19... {*Normal, Abnormal.*} Date of Quickening.....19...

Previous Pregnancies, Number.....Vomiting, Headache, Oedema.....Miscarriages No.....

Labor, Difficult, Instrumental, Prolonged.....Puerperii, Fever.....

Present Pregnancy, Vomiting, Headache, Oedema, Etc.....General Condition.....

Children, Weight at Birth,.....No. Living.....Health.....Causes Death.....

ANTEPARTUM EXAMINATION,

Made { Before Labor. / In.....Stage of Labor. / Dry Labor. / Intact Membranes. / Ruptured Membranes.

EXTERNAL.

Date of Examination..... .....19.....

General Condition .....Lungs.....Heart.....

Breast, Nipples, Lacteal Capacity.....Abdomen and Uterus.....

Fetus, Size.....Location, Head.....Back.....Small Parts..... {Foetal Movements, *Yes, No*

Presentation,.....{*Above, In, Below*} Brim. Position.....Foetal Heart {Rate..... / Location .....

Measurements, Intercrestal.....inches, Interspinous.....inches, Intertrochanteric.....inches, External Conjugate.....inches, Right and Left Oblique {R..... / L.....inches.

INTERNAL.

External Genitals and Vagina, Perineum.....Cystocele, Rectocele, Discharge.....

Cervix, Position.....External Os {Open, Closed ..... Internal Os} Open, Closed.....

Internal Measurements, Pelvis, Diagonal Conjugate.....inches, True Conjugate.....inches

Interischial.....inches, Flexibility of Coccyx.....Abnormalities.....

SUMMARY OF EXAMINATION.

Size of Foetus, Estimated .....Size of Pelvis.....Probable Character of Labor.....Quantity of Liquor Amnii, Estimated.....

Probable Date of Labor,.....19.....Presentation.....Position.....

Abnormalities, Plural Pregnancies, ...

Addenda.....

.....

.....

.....

.....

.....Exam. Phys.....

HISTORY OF LABOR.

Time of Call.....A. P. M.....19.....**Arrival**.....A. P. M.....19.....**Length of Gestation**.....Weeks

Patient, General Condition.....Before Labor, **T**.....**P**.....**R**.....Foetal Heart.....

Position of Parturient.....**Antepartum Douche**, { *Yes*, / *No*.

	FIRST STAGE.	SECOND STAGE.	THIRD STAGE.
Began At, ...	.....A. P. M.,....., 19...	.....A. P. M.,....., 19...	.....A. P. M.,....., 19...
Duration, ...	.....Hours,.....Minutes.	.....Hours,.....Minutes.	.....Hours,.....Minutes.
Uterine Contraction, . . .			
Hemorrhage, { *Source*, / *Amount*, . .			
Membranes, { *Intact*, / *Ruptured*. . . / *Delivery*,			
Vagina, { *Examinations*, / *Condition, P.P.* .			**Total**.....
Presentation, { *Position*, / *Restitution*, .			
Delivery, { *Operative*, / *Spontaneous* . .			
Cervix, { *Dilatation*, / *Tears*, ...			
Perineum, { *Condition*, / *Management*, / *Tears*,			
Cord, { *Prolapsed*, / *Management* . . . . / *About Neck*,			*Cord tied before or after Lung expansion*, ...
Manipulations, ...			
Medication, { *Diet*, / *Anæsthesia*, .			
Bladder--Rectum, ...			

During Labor--Patient's T.....**P**.....**R**.....and **Foetal Heart**.....

Placental Delivery, Method.....Time.....A.P.M.....19.....**Post Partum Douche** { Vaginal / Uterine .....

Actual Presentation.....**Actual Position**.....**Total Duration of Labor**,.....Hrs.....M

Uterus Tonicity.....Height above Pubes.....inches. **Delivered by**.....
(*Taken one hour after labor.*) **M.D.**

Complications and **Operations**.....

.....

.....**Performed by Dr.**.....

CHILD'S RECORD.

Date of Birth.....A. P.M.....19.....**Sex**.....**Maturity**.....Weeks. **Weight**.....Lbs.....Ozs.

Total Length.....inches. **Living, Stillborn, Macerated. General Condition**.....

Circulation { *Cyanotic*, / *Normal*, / *Anæmic*, } **Pulse** .....**Temperature**.....**Respiration** ..... { *Artificial*, / *Spontaneous*, / *Resuscitation*, } Method..... / Time Required...M

Caput Succedaneum, { Size, / Location,.....Moulding.....Size of Fontanelles..... { Defecated, *Yes*, *No*. / Micturated, *Yes*, *No*.

Anomalies, Injuries, Umbilicus, Genitals, Eyes, Ear, Nose, Mouth, Skin.....

Circumferences, Bisacromial,.....Inches. **Suboccipito--Bregmatic**.....Inches.

Diameters, Biparietal.....Inches. **Suboccipito--Bregmatic**.....Inches. **Occipito--Mental**.....Inches.

Bisacromial.....Inches. **Length, Cord**.....Inches, Insertion.....

Placenta, { *Complete*, / *Incomplete*, } Size.....Form .....Anomalies .....

Membranes, { *Complete*, / *Incomplete*, } Site of Rupture.....Anomalies.....**Plural Births**, Placenta, Membranes, Cord.....

DAILY RECORD OF CHILD.

Name of Child.....**Confinement No.**.....**Sex**.....
Weight at Birth.....Lbs.....Ozs. **General Condition**.....Nourished,.....Color, Cry.....
Anomalies, Injuries.....Has Patient { *Urinated,* / *Defecated.*

The Babies' Temperature, Pulse, and Respiration taken only where speeially indicated.

DATE.						
DAY.	DAY OF BIRTH.		FIRST.		SECOND		THIRD
VISITS.	A.M. VISIT	P.M. VISIT.	A. M. VISIT	P. M. VISIT	A. M. VISIT	P. M. VISIT	DAILY
UMBILICUS, BLEEDING, HEALED, CORD OFF PUS.							
DIET, QUALITY, QUANTITY NURSING.							
STOOLS NUMBER COLOR.							
WEIGHT.							
VOMITING							
TEMPERATURE.							
PULSE.							
RESPIRATION							
SKIN, COLOR, ERUPTION,							
EYES, DISCHARGE.							
GENERAL CONDITION.							
TREATMENT.							
ATTENDANT'S NAME.							

DATE.						
DAY.	FOURTH	FIFTH	SIXTH	SEVENTH	EIGHTH	NINTH
VISITS.	DAILY	DAILY	DAILY	DAILY	DAILY	DAILY
UMBILICUS, BLEEDING PUS CORD OFF HEALED.						
DIET, QUALITY, QUANTITY, NURSING.						
STOOLS, COLOR NUMBER.						
VOMITING.						
WEIGHT.						
TEMPERATURE.						
PULSE.						
RESPIRATION						
SKIN, COLOR, ERUPTION.						
EYES, DISCHARGE.						
GENERAL CONDITION.						
TREATMENT.						
ATTENDANT'S SIGNATURE.						

Remarks.....

EXAMINATION ON.....**DAY AFTER BIRTH**.....19....., (This Examination is made at last visit.)
General Condition.....**Umbilicus**.....**Eyes**.....**Skin**.....**Weight**.....Lbs.....Ozs.

Died, Discharged, or Transferred (TO.....HOSPITAL) **On**.....19 .....**Condition** { **Good,** / **Fair,** / **Poor,** / **Critical.**

Remarks, Artificial Feeding.....
Urine Reports, Mothers.....

PUERPERIUM.

DAILY RECORD OF MOTHER

DATE.						
DAY.	LABOR DAY		FIRST		SECOND	THIRD
VISITS.	A. M. VISIT	P. M. VISIT	A. M. VISIT	P. M. VISIT	A. M. VISIT	P. M. VISIT	DAILY
BREASTS, CONDITION, SECRETION NIPPLES.							
LOCHIA, CHARACTER, ODOR, QUANTITY.							
FUNDUS, CONDITION HEIGHT.							
STOOLS, CHARACTER NUMBER.							
PULSE.							
TEMPERATURE.							
RESPIRATION.							
URINE, QUANTITY.							
DIET.							
GENERAL CONDITION.							
TREATMENT.							
ATTENDANT'S NAME.							

DATE.						
DAY.	FOURTH	FIFTH	SIXTH	SEVENTH	EIGHTH	NINTH
VISITS.	DAILY	DAILY	DAILY	DAILY	DAILY	DAILY
BREASTS, CONDITION, SECRETION, NIPPLES.						
LOCHIA, CHARACTER ODOR QUANTITY.						
FUNDUS, CONDITION, HEIGHT.						
STOOLS, CHARACTER, NUMBER.						
PULSE.						
TEMPERATURE.						
RESPIRATION.						
URINE, QUANTITY.						
DIET.						
GENERAL CONDITION.						
TREATMENT.						
ATTENDANT'S NAME.						

Features of Puerperium.....

.....

.....

.....

.....

.....

.....

.....

EXAMINATION ON.....DAY AFTER LABOR.....19....., (Made at Last Visit)

Uterus, Size.....Position.....Sensibility.....Mobility.....

Perineum, Condition.....Cystocele, Rectocele, Rectal.....Continence, Prolapse.....

Cervix.....Lochia, Quantity.....Color.....Odor.....

Breasts, ...Nipples.....Remarks.....

Discharged, Died, or Transferred (TO.....HOSPITAL) On.....19.....Condition { Good, Fair, Poor, Critical.

Total Days Treated.....

Signature.....M. D.

INDEX.

A.

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